

R. Leacock



PRINCIPAL CONTENTS

"Soil Alkali" Investigations at Tresco
Marketing Meat in London
Stock Diseases
The Care of Cream
Crop and Fallow Competitions
The Government Standard Herd Test



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OF

THE DEPARTMENT OF AGRICULTURE,

VICTORIA, AUSTRALIA.

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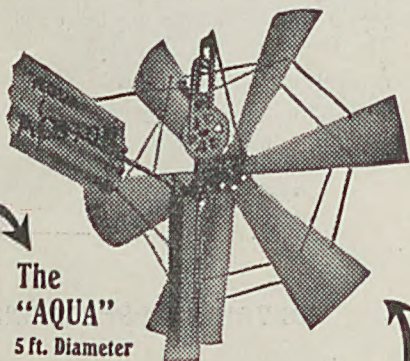
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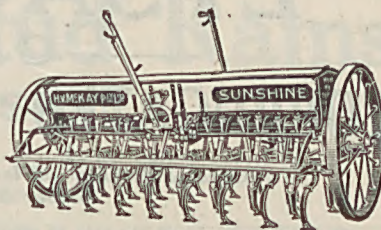
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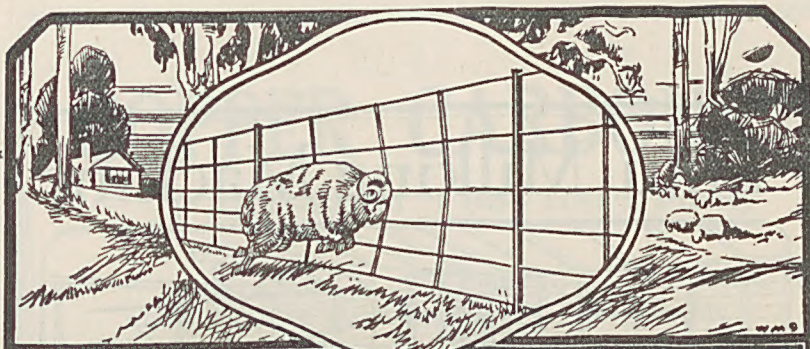
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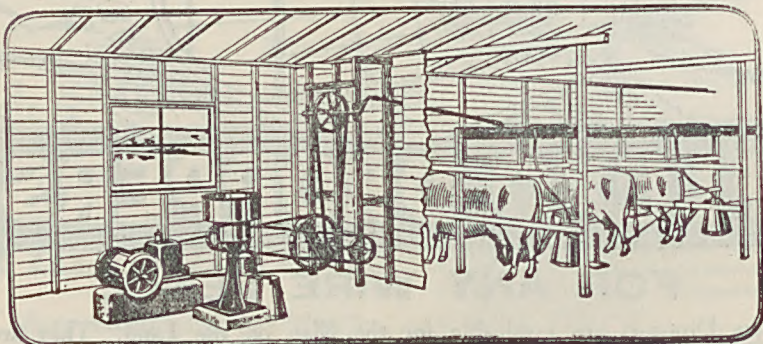
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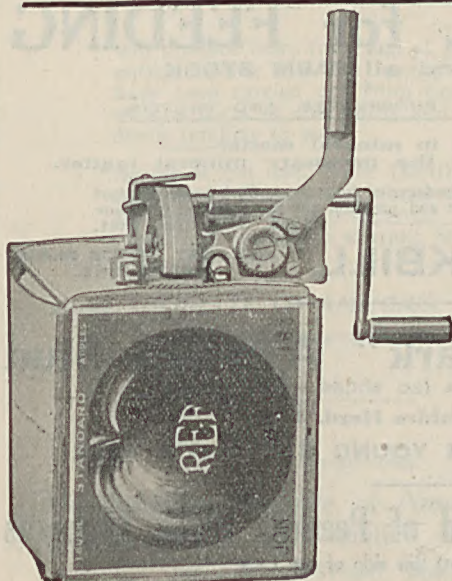
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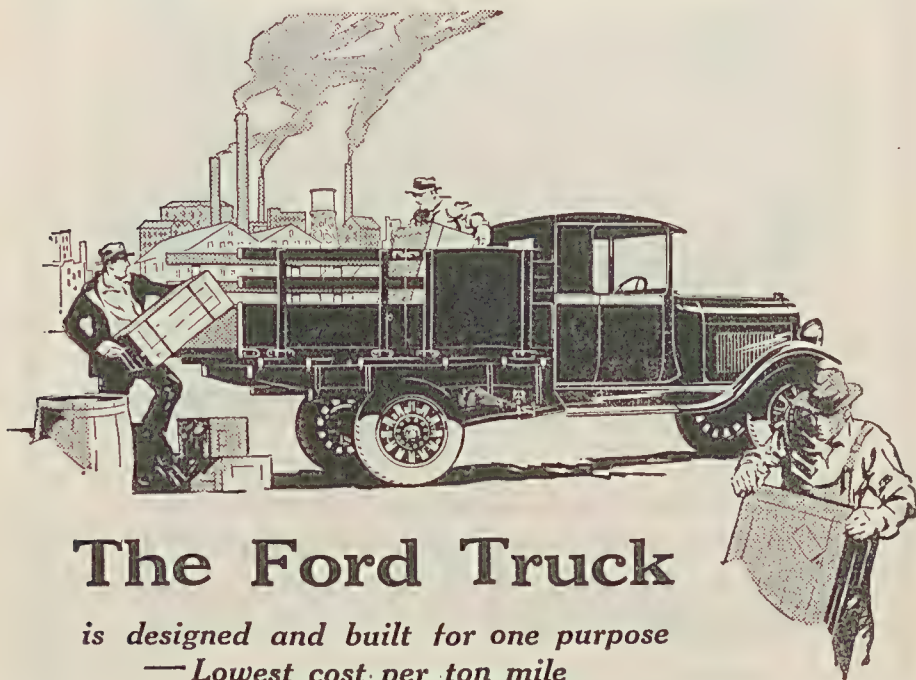
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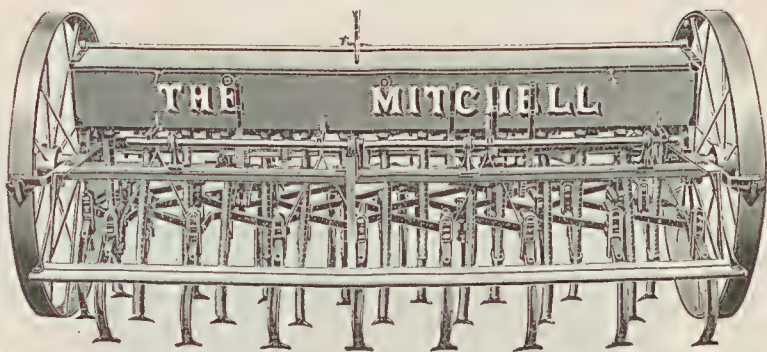
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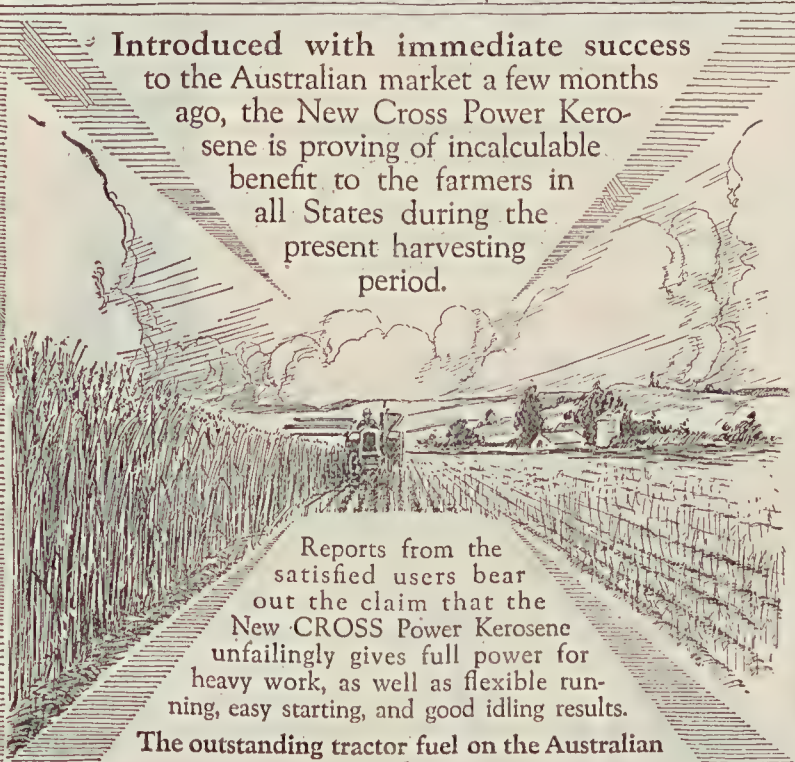
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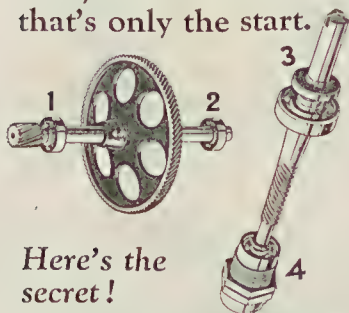
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Vol. XXVIII.

February, 1930.

Part 2

“SOIL ALKALI” INVESTIGATIONS AT TRESCO.

Frank M. Read, M.Agr.Sc., Horticultural Research Officer.

INTRODUCTION.

For many years, the condition of citrus groves on much of the Mallee land of the Murray Valley has been unsatisfactory; and from the time of the earliest plantings areas have been dying out. The position, however, was not acute until recent years for, on most of the areas found unsuitable for citrus, vines for dried fruit were planted and flourished.

During the latter part of the war period, and subsequently, the acreage under vines was increased to an enormous extent, both in this country and America, resulting in over-production and unprofitable returns. To replace citrus with these crops is, therefore, now quite unattractive, and Doradillo grapes for distillation purposes—about the only other alternative—are even more insecure.

Citrus-growers in the district in question have, therefore, been for the past five years and more in the precarious position of being unable to maintain the health of their trees, and unable for economic reasons to support themselves on the relatively small areas at their disposal by growing any other crop.

At Tresco, where the first plantings took place only just prior to the war, the trouble was intensified by the circumstances described. Thus, for the first time was the necessity for thoroughly investigating the position fully appreciated.

The Tresco settlement was established by Australian Farms Limited in 1913. It lies in the Mallee country some 8 to 10 miles on the Victorian side of the River Murray—14 miles south of Swan Hill.

The settlement spreads itself over two typical pine ridges, running north and south, more or less parallel, and about 2 miles apart; and over the intervening flat country. The total area originally intended for irrigation was a little under 4,000 acres. Citrus trees and vines, in the proportion of approximately two to one, comprised the main plantings.

The native vegetation on the ridges consisted of Murray pines and fairly large Mallee scrub; while that on the flats was mainly medium Mallee scrub.

The area was watered by pumping from Lake Boga—the lake being filled from the Murray by the Little Murray, and though early records of the salt content of the irrigation water are lacking it is known that, when the State Rivers and Water Supply Commission assumed control of the irrigation supply in 1922, the concentration of sodium chloride was as high as 95 parts per 100,000. It is concluded that the water frequently reached a dangerous level of salinity.

Again, the original irrigation channels were huge earthen structures, frequently 30 feet and more in width, from which the loss of water by seepage must have been, in these sandy soils, very great. The reason put forward for the construction of these unnecessarily large channels was that they could be constructed by horse labour cheaper than smaller ones could be made by hand. Ultimately, however, these were replaced by concrete channels, of which very few exceeded 6 feet across.

For five or six years the settlement flourished; but at that stage serious trouble became noticeable on the flats. Both vines and citrus trees begin to die; and it was discovered that a water-table had been formed within a few feet of the surface. This condition was doubtless brought about by heavy irrigation on the flat land, and by the seepage of excess water from the adjoining ridges.

At the same time, mineral incrustations appeared on the surface of the soil. A great deal of the flat land was therefore abandoned. From then on, patches of citrus, first on the rising ground and later even on the hill tops, became unthrifty. The vines on the high land, however, have continued for the most part to yield good crops.

By 1923 and 1924 the position was seen to be grave, the trouble extending, despite many and varied remedial measures applied by the growers. In response to their requests for a thorough investigation of the position the Irrigation Research Committee, in September, 1925, appointed a sub-committee to carry out this work. The sub-committee consists of Messrs. H. A. Mullett, B.Agr.Sc., Agricultural Superintendent, J. M. Ward, Superintendent of Horticulture, S. A. Cock, Citriculturist of the Victorian Department of Agriculture, and Mr. J. A. Aird, B.Ag.Sc., B.Sc., of the Victorian State Rivers and Water Supply Commission, and the writer.

Preliminary Investigations.

It was considered that before any experiments could be laid out at Tresco certain work of a preliminary nature should be done. This work fell naturally under two headings—

1. A "Flying Survey," by which was meant the sifting and collation of such data as could be obtained by interrogation of the settlers; and an examination of the more obvious factors apparently associated with the trouble.
2. A more detailed survey, embracing a systematic boring of the soils of typical blocks on the settlement; and chemical examination of soils and soil water.

Results of "Flying Survey".

1. The first noticeable effect on the citrus trees is a mottling of a proportion of their leaves—the intervenous areas taking on a yellow colour. This gradually extends for a couple of years until the majority of the leaves are so affected. During the winter months the foliage of affected trees turns very yellow, and, in late winter or early spring, wholesale defoliation takes place. In bad cases all the leaves may be lost. Such trees, especially if they are pruned hard, will usually throw out leaves in the spring; but these are frequently undersized. They may acquire quite a healthy appearance, but in the course of a year or so they usually succumb once more to mottling and defoliation. All of this is, of course, typical of injury to citrus trees on saline and alkaline soils. Finally they die.

2. It is not uncommon for defoliation to be severe just after a good crop has been picked in warm weather. This is very interesting, because, as Bartholomew* has shown, the fruit is capable of acting as a reserve of moisture for the leaves. If, in these saline soils, the fruit is being used for this purpose, in the beginning of the warm season, because the roots are unable to keep pace with transpiration in peak periods, it is conceivable that the picking of the crop at such a time would be a powerful stimulus to defoliation.

It would seem that, as a reasonable precaution, trees on such soil should, if possible, be picked only in cool weather, during that period when, just prior to the first irrigation, the soil is usually dry.

3. It was disclosed in the "Flying Survey" that affected trees had very few fibrous roots as compared with healthy citrus trees, although the root framework appeared quite normal. In very sick trees these fibrous roots were almost entirely absent.

4. The quantity of irrigation water used on the settlement was seen to be very high. According to figures supplied by Mr. Wallis, the local officer of the Water Supply Commission, sufficient water to give to the area irrigated 9 acre inches had been pumped by the Commission's plant in the irrigation preceding this survey. The loss by seepage from the channels could not have been high, because most of them were lined with concrete. One obvious reason for such a high consumption of water was the unsatisfactory lay-out of the irrigation system on many of the blocks. Furrow irrigation was used almost exclusively, and the average length of these furrows must have been in the vicinity of 10 chains. They varied from a few chains up to more than 17 chains.

In the case of the longest run, the land close to the head ditch was, of necessity, water-logged before the remote trees could receive any irrigation water.

5. No conclusive evidence was to be obtained on the relative susceptibility of the different types of citrus to the trouble, but it appeared that the lemon was somewhat more susceptible; and the navel slightly less than the remainder.

It was likewise impossible to determine the influence of the different stocks, the vast majority of the trees being worked on the wild lemon.

* "Internal Decline of Lemons III. Water deficit in lemon fruits caused by excessive leaf evaporation." *American Journal of Botany* XIII: 102-117, February, 1926.

6. Although drainage had been looked upon locally as the best remedy for such soil conditions the results obtained from tile draining at Tresco were rather disappointing. Practically all the drains had been laid 3 feet to 4 feet below the surface, their distance apart ranging upwards from 48 feet.

It appeared that the most efficient depth and distance apart at which the tiles should be laid needed to be determined.

7. Two distinct types of surface soil were noted. The better groves—and a few were still very good—were located on a red sandy type, usually situated on the higher levels.

The poorer groves, and areas where the trees had already died, showed, for the most part, a greyish-red, somewhat heavier type of soil, apparently much less sandy and not so deep. In places the



Fig. 1.—Showing Cloddy Nature of the Soil of Sloane's Grove, Tresco.

The clods set very hard and, despite thorough working, this characteristic persists in such soils.

rubby limestone subsoil came to the surface, and on these patches the trees were said to have succumbed the soonest.

It was quite noticeable that, whereas the tilth of the good groves seemed exceptionally easy to maintain, the surface soil of the affected groves was frequently cloddy; and, unless great care was taken, the clods set very hard. (See Figure 1.)

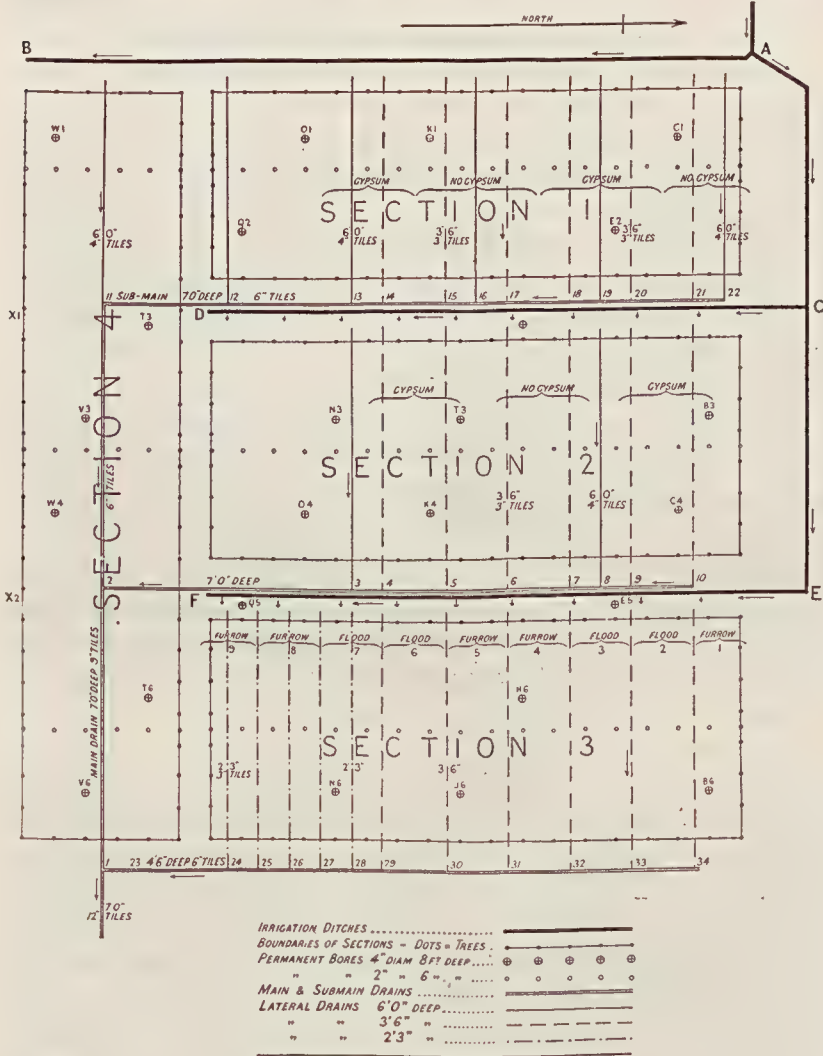
The results of the systematic boring and chemical analyses of these soil types will be discussed later; it has not been possible to complete them for inclusion in this section.

Field Experiments.

At the conclusion of the preliminary surveys of the settlement, it was considered advisable that one grove be taken over for a period of

at least three years for the purpose of making detailed observations of the conditions obtaining, and of laying out certain experiments.

Consequently the committee, by an arrangement with Mr. A. Sloane, assumed the control of his grove of 8½ acres.



Plan of Experimental Block, Tresco.

This grove had been planted in 1915, and was purchased by Mr. Sloane in 1919. At that time it looked one of the best groves on the settlement. From 1921, however, it began to deteriorate rapidly, until, at the time these experiments were begun, at least two-thirds of the trees were badly affected. The soil is of the greyish-red heavier type, except for a small patch in the north-east corner.

A plan of the lay-out of the grove on page 69 shows the details mentioned in the discussions of the experiments made. The lay-out of the drainage system, &c., will be considered in detail in a later section of the report.

Experiment 1—Length of Run in Irrigation.

It was apparent from first principles of irrigation that many of the runs used in irrigating the Tresco groves were too long. Take the typical example of Sloane's grove, where the distance from the head ditch A-B (see plan page 69) to the bottom of the orchard was 10 chains, watered by four furrows per row of trees, running the entire length.

The water ran in these furrows for upwards of 36 hours, for a medium watering; but it was only during the last few hours that it was passing the trees near the bottom. Thus these bottom trees rarely went from one irrigation to another without some wilting; while the top of the orchard was generally extremely water-logged by the time each irrigation was completed. This case was by no means extreme, for furrows of at least 17 chains were in use.

Such a state of affairs not only makes for uneconomical use of water, but is also dangerous in that the consequent over-watering of the top portion rapidly makes for its deterioration by establishing contact with the more salty layers of the deep subsoil, thus rendering possible the upward diffusion of soluble salts. Ultimately a water-table is formed near the surface, and the rise of soil moisture to the surface, by capillarity, from this water-table carries the soluble salts, and concentrates them there.

When Sloane's block was taken over for experiments, new channels, A-C-D and C-E-F, were constructed so that, on three-quarters of the area—sections 1, 2, and 3—the maximum run was a little more than 3 chains. One-quarter of the grove, however—section 4—was set apart on which to study the effect of long runs of 10 chains, and was still watered from the old channel A-B.

During the season 1926-27 this area was watered just as it had always been—4 small furrows (carrying about 0.05 cusecs. each) per row of trees. The channel was furnished—as are most of the Tresco irrigation ditches—with a 2-inch outlet pipe every 12 feet, i.e., two pipes per row, and the stream used was the maximum that could be sent through these pipes. For purposes of examination the run was divided into three portions—top, middle, and bottom, each a little over 3 chains long. Systematic borings of these thirds were carried out, and moisture determinations were made.

Table 1 shows the result of these trials after the first irrigation,* and it is seen there that the top of the run has been heavily over-watered.

The experience during this irrigation was that, when the wheel had measured out sufficient water to give a 6-acre-inch application for this section, the bottom third of it was by no means sufficiently watered. For the purpose of the experiment, irrigation was then discontinued; but there can be no doubt that, in practice, a grower would have gone on

* In any irrigation after the first a strict comparison is not possible, for, even when these later irrigations commence, the subsoil of the top of the run is so wet that it can absorb very little more water. However, between the last irrigation of one year and the first of the next, the grove can be dried out to at least 6 feet deep.

to apply at least 8 acre inches, of which the top third would have received nearly 1 acre foot, and the bottom hardly 3 acre inches. Graph 1 shows that after this irrigation the height of the water-table was as follows:—

Top Third—2 ft. 4 in. from surface.

Middle Third—4 ft. 7 in. from surface.

Bottom Third—not within 8 feet of the surface.

On those sections, however, where the run was only $3\frac{1}{2}$ chains, and where border flooding was adopted, 6 acre inches gave an apparently uniformly heavy irrigation to every portion. Only with difficulty could more water have been applied.

In the subsequent irrigation season, 1927-28, a somewhat different system of irrigation was adopted, in order to see if a uniform distribution could be carried out, even with runs of 10 chains. One large furrow per row took a stream of approximately 0.20 cusecs to the bottom third, where it was turned into bays 12 feet wide, as in border flooding.

When the bottom third was completed, the furrow was intercepted higher up to similarly water the middle-third; last of all the top third was flooded from these furrows. This method of watering was rendered possible by replacing all the 2-inch outlet pipes with 4-inch pipes. From the former the large stream could not have been obtained. Table 1 shows that, for the first irrigation, 1927-28, this resulted in a somewhat more even watering, but still far from ideal.

After the first watering in 1927-28 larger heads of water were used; and about 0.25 cusecs was carried in each furrow, as outlined above. While, as can be seen, this greatly increased the evenness of distribution (see Table 1—first irrigation 1928-29), it is doubtful if such large heads could be extensively used in this way in practice; and even with these there is some over-watering at the top of the run.

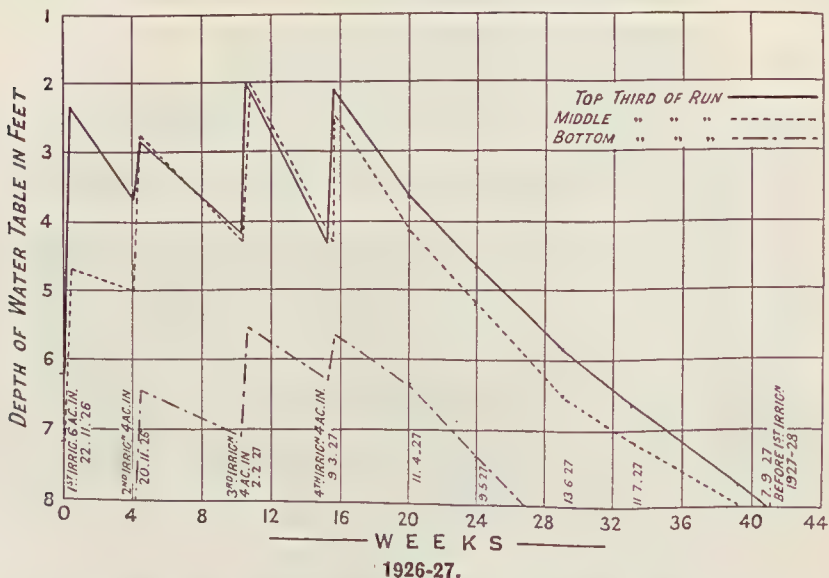
Studies of the Water-table.

Further evidence on this question has been secured from a study of the height of the water-table on the top, middle, and bottom thirds of this long run.

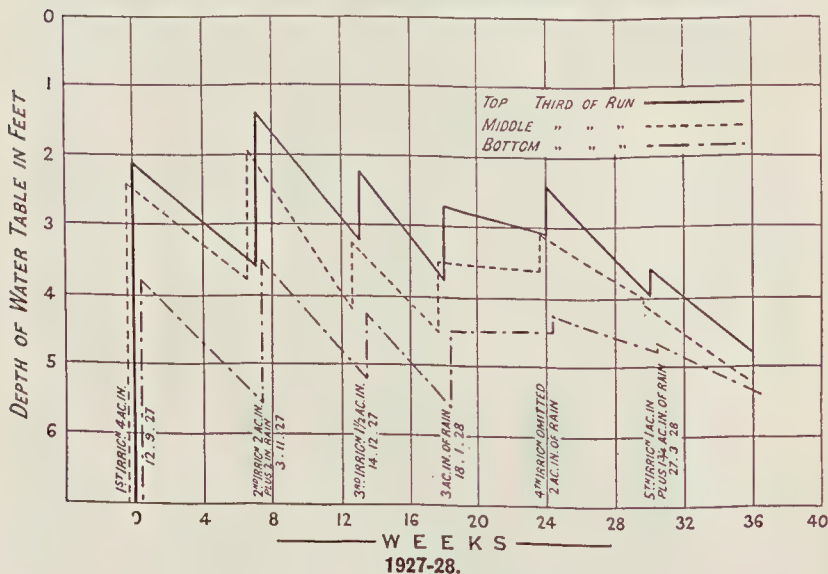
During the season 1926-27 two bores to 8 feet on each portion of the long run were measured weekly, and the average reading is recorded in Graph 1, which covers the whole period from the first irrigation 1926-27 season to just before the first irrigation in the following season. It will be seen that the water-table was always from 3 to 4 feet lower on the bottom section than on the other two portions; and that it was within 6 feet of the surface for only six weeks of the year—its highest reading being 5 ft. 6 in. from the surface. On the middle section it was for 28 weeks, and on the top for 30 weeks, within 6 feet of the surface; while, for an appreciable time, they were both within 2-3 feet—the highest reading in each case being 2 feet from ground level. This may be taken as approximately the conditions which obtained on the grove in the past; and is, without doubt, typical of what has been and is still going on in many of our irrigated holdings.

It also largely explains why the best portion of this grove was situated in the bottom third, the affected area extending in a huge semicircle, having the old irrigation ditch, A-B, as its base.

Throughout the seasons 1927-28 and 1928-29 a line of six permanent bores—one per row of trees—has been maintained across the middle of each of the three portions, and weekly readings of the posi-



Graph 1.—Water Table, Section 4, Sloane's Grove, Tresco.



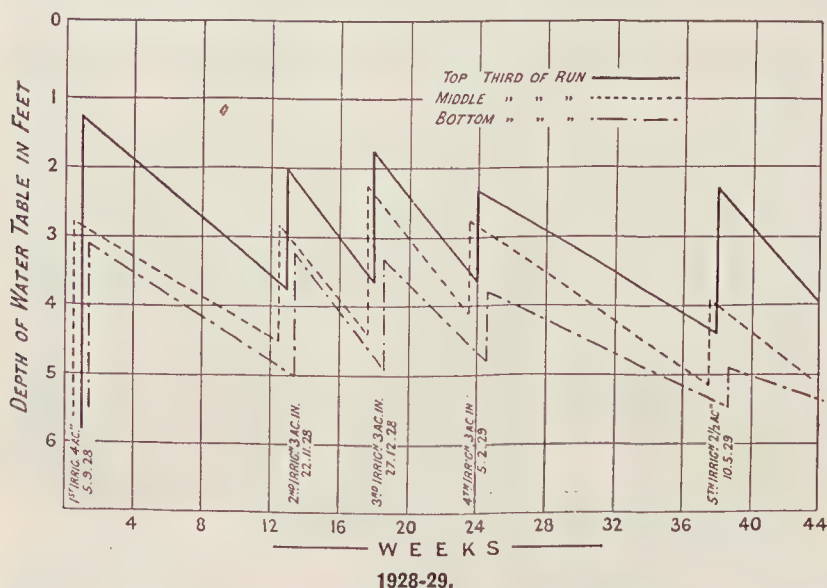
Graph 2.—Water Table, Section 4, Sloane's Grove, Tresco.

tion of the water-table in each of the bores have been taken. The readings of the six bores in each section have been averaged, and from the resulting figures Graphs 2 and 3 have been compiled.

Graph 2 shows the position of the water-table for season 1927-28 at each section of the run. The graph covers the period from the first irrigation to a date six weeks after the end of the last irrigation in that year—the peaks denoting the sudden rise at each irrigation.

Graph 3 shows the corresponding details for season 1928-29.

It will be seen that the water-table near the top of the run has been consistently 1 to 2 feet higher throughout the two seasons than that near the bottom, despite the improvement in the distribution indicated previously in Table 1.



Graph 3.—Water Table, Section 4, Sloane's Grove, Tresco.

Short Runs Compared with Long.

A comparison of the distribution of water in the long runs on section 4 of Sloane's grove with that on section 2, where the runs are a little more than 3 chains, shows that, for the first irrigation under the latter system, the soil was far more evenly wetted. (See Table 1.)

This is supported by Table 2, which shows the moisture contents of the layers of soil to a depth of 6 feet from a line of bores along the top of section 2, and another line along the bottom of this section, bored before and after each irrigation throughout the year. These figures are compared with others from similar lines of bores sunk at the top of the long section, one-third of the way down, two-thirds of the way down, and a fourth line at the bottom. The average for all determinations throughout the year for each of three years is given in Table 2.

It will be seen that the short runs can be fairly uniformly wetted throughout their length; whereas the long runs, as was brought out also in Graphs 1, 2, and 3, receive much more water at the top than at the bottom.

Conclusions on Length of Run.

From the results put forward, and from the general experience of watering the experimental block for four seasons, the conclusion has been reached that on land of this sandy type, with moderate grade, the runs should not exceed 3 to 4 chains. Even where the grade is fairly steep 5 to 6 chains may be considered a maximum.

This will involve additional ditching; and, although concrete structures are desirable in that they reduce loss by percolation, if kept in good repair, and are more easy to manage and maintain, yet it is preferable to reduce the length of run by the use of earthen ditches, where the grower cannot afford concrete, rather than to irrigate in long furrows or bays.

Many growers believe that in using earthen ditches, as suggested, they run a great risk of seepage from them. The loss from a reasonably well-constructed ditch, of the size which would be generally used, say, 1 cusec. capacity, has been estimated by Fortier* at 25 per cent. per mile. Supposing earthen ditches had been used on Sloane's grove, instead of the concrete ditches A-C-D and A-C-E-F, and that they had been extended respectively to the points marked X_1 and X_2 , the grove would have been divided up into three sections—the length of run being nowhere more than $3\frac{1}{2}$ chains.

Now, in watering the middle section from channel A-C-D-X, which is 13 chains long, only approximately 4 per cent. of the water applied to that section would have been lost by seepage from the earthen channel.

Channel A-C-E-F- X_2 , which is 16 chains long, would have lost 5 per cent. of the water designed for the bottom section.

Presuming that the concrete channel A-B lost nothing from this source, the average loss from seepage from the ditches over the whole grove would have been 3 per cent., compared with which the seepage from the heavily over-watered land near the head ditch A-B, under the old system of irrigation, was relatively enormous.

Change of Grade.

Another objection to many long runs is a change of grade throughout their length, which makes it practically impossible to effect even watering. The long rows on Sloane's grove will serve again as a very good example. The top third is relatively flat, and a large stream is necessary to force the water along. The slope increases in the middle third, and is much steeper on the bottom third, where the water is very difficult to hold for a sufficient length of time. It could be held more easily by reducing the stream, but this increases the difficulty of forcing it over the flat portions without excessive soakage.

A change of grade on any run should not be tolerated; but a ditch should be constructed at the junction of the two grades.

* "Use of Water in Irrigation."

TABLE 1.

Moisture Content of Top, Middle, and Bottom thirds of 10-chain irrigation runs, Sloane's grove, Tresco, after the first irrigation in each of the three years 1926-27, 1927-28, 1928-29:—

Layer Sampled.	Moisture Content per cent. of Dry Soil.								
	Furrow Irrigation, 1926-27.			Semi-Flood Irrigation, 1927-28.			Semi-Flood, Larger Streams, 1928-29.		
	Top.	Middle.	Bottom.	Top.	Middle.	Bottom.	Top.	Middle.	Bottom.
Surface—2 feet ..	24.7	17.4	17.2	20.9	20.0	17.5	19.6	18.2	17.6
2—4 feet ..	24.4	15.1	15.7	20.9	20.2	18.6	20.2	18.1	17.8
4—6 feet ..	25.8	17.6	17.2	22.1	19.9	17.1	19.2	16.8	18.6

Corresponding Figures* for Top and Bottom of Section 2 where
Runs are 3½ chains. Flood Irrigation.

	1927-28.		1928-29.	
	Top.	Bottom.	Top.	Bottom.
Surface—2 feet	17.6	18.0	16.4	20.1
2—4 feet	17.4	16.6	19.0	18.5
4—6 feet	19.7	18.5	22.1	18.9

* 1926-27 first irrigation figures were not taken.

TABLE 2.

Comparison of average moisture contents throughout the year of soil to 6 feet deep at the top and bottom of 3-chain irrigation runs, with the corresponding figures for various points in a long run of 10 chains. Sloane's grove, Tresco:—

AVERAGE MOISTURE CONTENTS PER CENT. OF DRY SOIL THROUGHOUT THE YEAR.

Layer Sampled.	Section 2—3-chain runs.		Section 4—10-chain runs.			
	Top.	Bottom.	Top.	3½ chains down.	6½ chains down.	Bottom.
1926-27.						
0-2 feet ..	17.4	17.9	18.1	17.6	16.6	14.8
2-4 feet ..	19.0	17.6	19.5	19.9	17.6	15.3
4-6 feet ..	18.9	19.2	20.5	19.9	18.5	15.5
1927-28.						
0-2 feet ..	15.2	15.5	17.8	17.9	16.9	15.2
2-4 feet ..	15.6	16.0	18.8	18.1	16.0	16.1
4-6 feet ..	17.6	17.9	18.8	18.3	18.0	15.7
1928-29.						
0-2 feet ..	16.3	16.1	17.9	16.8	16.6	15.5
2-4 feet ..	16.7	17.2	18.8	17.6	15.7	16.3
4-6 feet ..	17.5	17.4	18.5	17.6	17.7	16.4

Experiment 2.—Flood Irrigation versus Furrow.

The conclusion was reached from the results of the preliminary survey of the Tresco settlement that a high concentration of soluble salts, of which the most important appeared to be sodium chloride, occurred on affected groves, especially near the surface; and that this constituted one of the main factors contributing to the death of the trees.

The data suggested that the health of the trees could not be maintained where the average concentration for the first 4 feet of soil exceeded 21 parts of chlorine (34 parts of common salt) per 100,000 of dry soil, with a maximum concentration of 29 parts (47 of common salt) in any 1 foot.

Later there will be recorded the results of an attempt to remove this salt from the grove by means of flood irrigation and tile drainage. The following experiment, however, was based on somewhat different considerations:—

The distribution of the salt in depth strongly suggested that the high-surface concentrations were largely due to the constant ascent of saline soil solution by capillarity, probably from the water-table, whenever it occurred near the surface. Under the influence of furrow irrigation, and a low rainfall of about 12 inches per annum, these salts were not washed down again, and therefore accumulated from year to year.

The substitution of border flooding for the furrow method suggested itself as a logical preventive of this upward leaching and a means of dispersing the excess salt of the surface layers, especially the top 2 feet, throughout the lower layers, which were relatively low. By this means it was hoped that, if the salt could not be entirely washed out of the grove with the help of drainage, it was possible to prevent its accumulation in the root zone. Most roots occur in the layer 6 inches to 2 feet 6 inches.

The use of overhead spray irrigation is, of course, even more desirable than flooding; but it was considered advisable to devise a method of watering, which would not involve such a large outlay. The Tresco groves would not stand the extra capitalization.

Accordingly 2 acres, known as section 3, watered by the channel E-F, and consisting of eighteen rows of trees, with eight trees in each row, were set aside for this purpose. They were divided into nine plots, each of two rows (48 feet) wide and eight trees (212 feet) long, i.e., sixteen trees per plot. The plots were numbered 1-9, beginning from the north. As the health of the trees and analyses of the soil indicated that the salinity of the soil progressively increased from north to south, and since, as will be seen from the plan of the drainage system, the area was not uniformly drained throughout, the plots were arranged in the system A, B, B, A, A, B, B, A, A, where A represents a plot furrow-irrigated, and B flood-irrigated.

When these plots were laid out, the five tile drains, 2 ft. 3 in. deep, which occupy the five rows on the south of this area had not been constructed. When they were put down half-way through the second season, i.e., December, 1927, it was considered desirable to test the effect of at least two of them under flood-irrigated plots, and so one row of plot 8, which had previously been furrowed, was irrigated by flooding from that date. Consequently the use of plot 8 for the experiment under review was lost, and figures for it do not appear after the first season.

To each of the nine plots, exactly the same amount of water was applied at each irrigation. Just prior to every irrigation, each plot was bored to a depth of 3 feet, and this boring was repeated as soon as possible after the watering. The bores were placed in line with the trees, i.e., 12 feet from the nearest drain. Four bores per row—eight bores per plot—were sunk, and samples were taken in the first year, 1926-27, at the following depths:—

Surface—1 inch.

1 inch—1 foot.

1 foot—2 feet.

2 feet—3 feet.

The samples for each layer from the eight bores were thoroughly mixed, and quartered down to get one sample per plot for each of these depths before and after each irrigation. These were analysed for moisture and chlorine.

After the first year it was considered advisable to take samples at—

Surface—6 inches.

6 inches—1 foot.

1 foot—2 feet.

2 feet—3 feet.

DISCUSSION OF RESULTS.

Table 3 shows the results of the chlorine estimations. All those samples taken before the several irrigations in any one season have been averaged; and likewise those taken just after.

The most striking feature of the table is that the chlorine in the plots flood-irrigated has been practically reduced to what is regarded as safe for citrus, and is consistently greatly lower, in every case, than corresponding furrow-irrigated plots. This has been accentuated as the experiment progressed. The result for the third year, 1928-29, is so clear cut that the irregularity in the soil and drainage of the plots, which has been previously referred to, is greatly outweighed, and a significant result obtained.

As some of the furrowed plots were beginning to look very bad, and since it was thought no useful purpose would be served by continuing the experiment and greatly harming those portions of the grove, the whole area has been flood irrigated from the beginning of the present season. At the foot of Table 3 are shown the figures for samples taken, exactly as previously, both before and after the first flood watering which these furrow plots received. The effect of this one irrigation has been to reduce, in a marked degree, the chlorine content of the previously-furrowed plots, numbers 1, 4, 5, 9.

A comparison of the before-irrigation figures for the flooded plots with the corresponding after-irrigation ones reveals the fact that although the former are on the whole somewhat higher, as would be expected, they are by no means dangerously so.

It was considered possible, prior to the experiment, that, although the flood irrigation washed the salts down, they would rise very rapidly, and in large quantities, by capillarity, under the conditions created, during those periods between irrigations at the end of which the before-irrigation samples were always taken. Table 3 shows that this is not so, and that, with reasonable care, no such danger exists in flood irrigating.

TABLE 3.

Showing Distribution of Chlorine (Cl_2) (expressed as Common Salt (NaCl)) under Flood Irrigation and Furrow. Average content of chlorine (as Na Cl) in parts per 100,000 of Dry Soil in the top 3 feet of Sloane's grove, Tresco. Before and after Irrigations.

SEASON 1926-27.

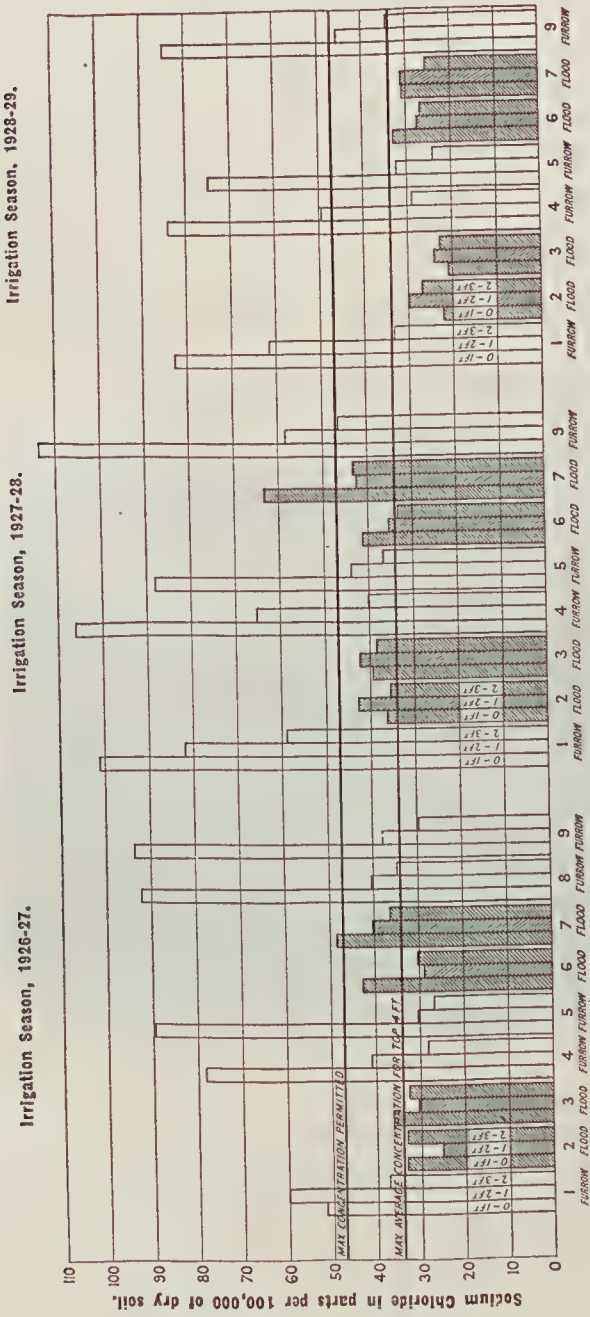
Layer Sampled.	Plot I. Furrow.		Plot II. Flood.		Plot III. Flood.		Plot IV. Furrow.		Plot V. Furrow.		Plot VI. Flood.		Plot VII. Flood.		Plot VIII.(b) Furrow.		Plot IX. Furrow.	
	Before.	After.	Before.	After.	Before.	After.	Before.	After.	Before.	After.	Before.	After.	Before.	After.	Before.	After.	Before.	After.
Surface Inchi(a)	49.4	54.8	97.4	46.5	72.5	117.0	46.0	174.0	661.0	373.0	158.0	87.0	121.0	114.0	670.0	291.0	462.0	492.0
1 in. to 1 ft.	42.7	63.1	32.3	22.8	28.2	33.9	64.7	58.5	44.3	56.4	40.2	31.0	37.6	46.9	52.6	61.6	53.0	53.0
1 ft. to 2 ft.	55.0	65.2	24.4	26.3	28.1	33.4	39.1	42.8	30.1	30.9	24.8	32.2	37.7	43.1	36.8	44.4	37.7	33.3
2 ft. to 3 ft.	36.5	38.1	29.1	27.5	29.3	36.1	21.5	32.2	21.2	32.4	24.7	38.2	32.7	40.5	27.4	42.2	29.5	29.8
SEASON 1927-28.(c)																		
Surface to 6 in.	143.0	74.9	49.7	27.7	51.1	30.3	174.0	73.4	138.0	71.0	58.2	35.7	114.0	48.5	..	..	204.0	84.1
6 in. to 1 ft.	91.4	95.5	34.3	34.0	41.7	35.4	86.6	90.8	79.4	63.6	33.8	37.5	45.5	45.0	..	..	86.3	80.3
1 ft. to 2 ft.	82.2	81.8	45.7	39.8	43.9	40.8	63.3	67.4	45.2	42.6	33.1	37.8	41.6	43.4	..	..	57.6	58.8
2 ft. to 3 ft.	60.2	57.7	38.5	32.7	42.1	34.9	38.2	42.4	34.8	38.6	31.8	35.1	40.5	46.0	..	..	43.2	49.7
SEASON 1928-29.																		
Surface to 6 in.	83.7	87.0	20.0	21.6	21.3	18.3	94.7	89.9	64.5	138.0	37.5	21.8	40.3	21.9	..	..	104.0	92.3
6 in. to 1 ft.	72.2	83.6	24.1	23.5	25.2	19.0	67.3	83.8	55.0	41.8	37.1	36.2	35.0	27.1	..	..	67.3	75.2
1 ft. to 2 ft.	62.5	60.2	30.1	29.5	26.4	21.9	47.5	51.1	32.8	31.9	25.7	29.6	37.8	24.7	..	..	48.2	42.7
2 ft. to 3 ft.	31.8	34.8	26.2	27.7	24.0	21.6	25.6	32.5	21.1	27.2	25.4	28.2	26.5	24.7	..	..	35.2	33.8
BEFORE AND AFTER FIRST IRRIGATION, 1929-30.(d)																		
Surface to 6 in.	137	47	26	12	28	14	137	36	137	46	58	18	51	27	..	..	172	61
6 in. to 1 ft.	69	66	21	18	18	10	81	42	54	34	36	31	33	30	..	..	63	49
1 ft. to 2 ft.	47	47	15	18	17	8	36	48	18	31	29	19	21	16	..	..	29	38
2 ft. to 3 ft.	23	19	15	14	19	14	17	40	14	19	24	19	23	19	..	..	19	27

(a) The sampling was altered after the first season (see text).

(b) Omitted after first season (see text).

(c) In this year showers were frequent, and only 8 inches of irrigation was applied. This is thought to explain the higher chlorine contents.

(d) All plots, including previous furrow plot s, now flood irrigated. † acre inches applied.



Graph 4.—Showing Distribution of Common Salt (Na Cl) in top 3 feet of Soil under two Methods of Irrigation—
Sloane's Grove, Tresco, 1926-29.

Graph 4 shows clearly the relative amounts of common salt present in the top 3 feet of soil, under the two methods of irrigation, for the three years 1926 to 1929. The whole of the analyses from each plot for the year have been averaged. The height of the columns is proportional to the salt content of the plots to which they refer. The graph illustrates the efficiency of flood irrigation in preventing the excessive accumulation of sodium chloride in the surface layers. The two heavy lines running across the graph refer to the figures quoted in the second paragraph on page 76. The fact that the columns of the flood plots rarely cut them—and never reach them during the last season—indicates that sodium chloride can be adequately controlled by this means. During the season 1927-28 only 8 inches of irrigation was applied, for frequent showers were experienced. These, however, were apparently not sufficiently heavy to replace the flooding, and the salt therefore increased.



Fig. 2.—Furrow Irrigation.

The water runs to the end of each furrow, and is then held in it by occasionally placing a shovelful of earth in different parts of the furrow.

Growers, however, should realize that excess of soluble salts is not the only trouble on such soils as these; and while it is considered that flood irrigation will prevent this trouble and effect an improvement in the position, it is not a panacea for all the ills to which citrus trees are heir. This treatment should be used in conjunction with others to be discussed in a later article.

Description of Watering Methods.

Furrow irrigation is illustrated in Figure 2. The length of the furrows is 212 feet, and the stream in each approximately 0.008 cusecs. The average stream taken in at the head-gate by growers is about

1 cusec., which, under these conditions, would suffice for 30 rows approximately, and would need to run for eleven hours to apply 3 acre inches of water.

It will be seen from the illustration that this method of applying water cannot prevent the accumulation of soluble salts in the surface layers of soil, under conditions where capillarity is a potent force, for it scarcely comes in contact with them—especially that land between the trees in the rows.

Figures 3, 4, and 5 illustrate the method of border flooding adopted, and are practically self-descriptive. For a heavy watering of 6 acre inches, a relatively small stream of 0.10 cusecs. per bay is used, and the surface is left in a somewhat rough state. Each bay should take about



Fig. 3.—An Aerial View of the Grove at the conclusion of Flood Irrigation.

The lay-out of the check banks is clearly shown. The bays are 12 feet wide.

three hours to water. For a light watering of 2 acre inches for the purpose, say, of germinating a green crop in the bays between the rows of trees, the surface is smoothed very level, and a large head of water, 0.20 cusecs. per bay, is rushed to the bottom in about half an hour. It has been found practicable to apply any required quantity of water by this means. The most convenient size of stream, however, will vary somewhat with the slope of the land.

The water is allowed to run down the bay to the bottom without much interference. It usually does this without spreading very much, for it is a fairly powerful stream. When it has reached the bottom

(where there is a good solid bank to prevent its getting away), the irrigator, by blocking its course with a few shovelfuls of earth here and there, beginning at the bottom and working up the bay, can throw it over the whole surface of the bay, in which fashion it proceeds until the desired quantity of water is applied.

A stream of 1 cusec. (cubic foot per second) running for 24 hours applies sufficient water to flood 2 acres 1 foot deep. From this, the grower should be able to roughly estimate the amount of water he is applying; or conversely how long it will take him, on any given area, to apply the quantity he decides upon. The size of the stream can be gauged approximately by an experienced water bailiff if there is no water-wheel on the grove.

It is essential for successful flooding that the side-fall on the bays be not too great. Thus the best direction for the bays is at right angles to the contours of the land. The side-fall can, however, be greatly minimized by intelligent working with the disc cultivators set at an



Fig. 4.—Showing the Approximate Height of the Check Banks Used in Flooding.

angle so that the earth is pushed a little every time in the desired direction. Any extensive grading, however, would need to be done with a buckscraper and smoother.

Check Banks.

The banks, which are illustrated in Figs. 3, 4, and 5, are put up before each irrigation and worked down again in the post-irrigation cultivation. This operation, too, is capable of aiding the grading. The banks can be constructed with such an implement as a ridger, but on the experimental grove it has been found convenient to throw up the banks with a double-furrow disc plough; and then with the disc cultivators, set in the required direction, work the earth towards the bank, so that the furrow made by the plough is filled in, and the bank strengthened. The height of the banks will depend on the fall of the land. The more side-fall, the stronger they will need to be. It is safe to err on the side of strength.

Where the fall of the land is greater than 9 inches per chain it has been found convenient to construct smaller banks between the rows of trees, at right angles to the main banks. This is very simply done by taking one cut with the disc-plough in this direction prior to constructing the other banks. This latter operation will break the smaller banks at their junction with the larger ones; but this is desirable because, as has been explained, the water is encouraged to run quickly to the bottom—usually it runs down just alongside the bank. When the irrigator wishes to spread the water he joins the banks with a shovelful of earth in each corner.

The Head Ditch.

Four-inch diameter outlet pipes have been used, and have proved very satisfactory. They can be regulated to give as small a stream for furrowing as a 2-inch pipe, if that is desirable, but have the necessary



Fig. 5.—A Close View of the Type of Flood Irrigation Adopted.

The water floods over practically every portion of the ground during the irrigation.

power in reserve should flood irrigation be practised. No grower should insert the smaller pipes into his concrete ditch without carefully considering whether he is ever likely to need larger ones. The added cost is very small. The difficulty of subsequent changing is, however, very great.

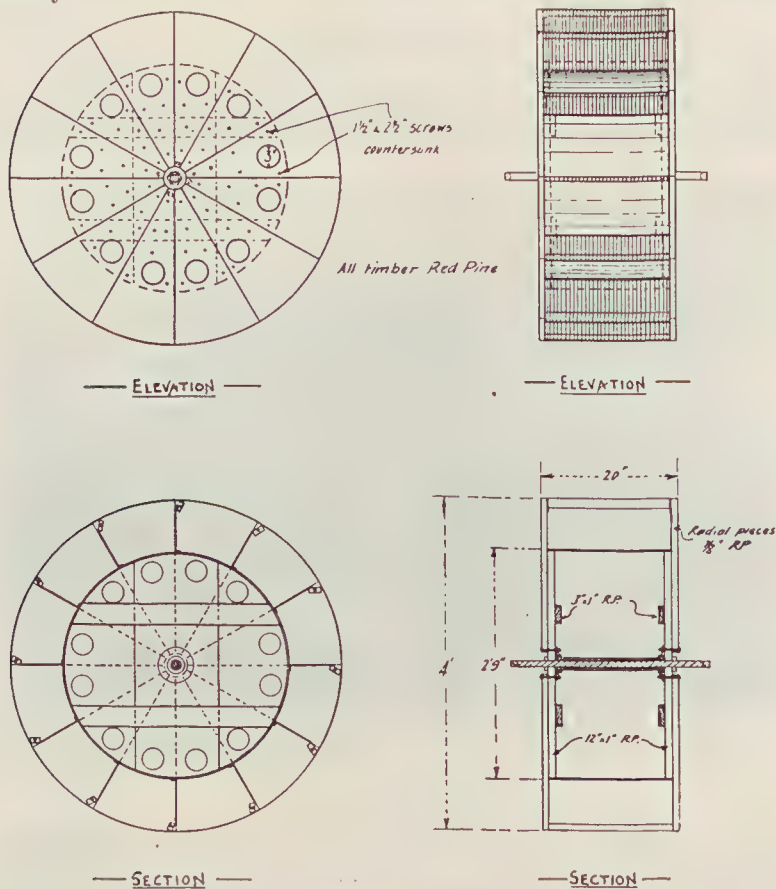
Another important point is that, for flood irrigation especially, the level of the water in the head ditch should be about 6 inches above the normal level of the land. Growers should insist on this point, and see that the contractor not only builds the channel high enough, but also inserts sufficient stops, which, on even medium slopes, need to be at frequent intervals if a head of water of 6 inches is to be secured

at any desired point. On the experimental grove the head ditches are fitted with a stop every row, i.e., every 24 feet. Efficient watering needs a well-constructed head ditch.

Summary.

1. Citrus trees on certain types of Mallee land have been unsatisfactory from the time of the earliest settlements.

2. Vines, however, usually do well on such soils, and were used to replace the trees until the post-war depression in the dried-grape industry.



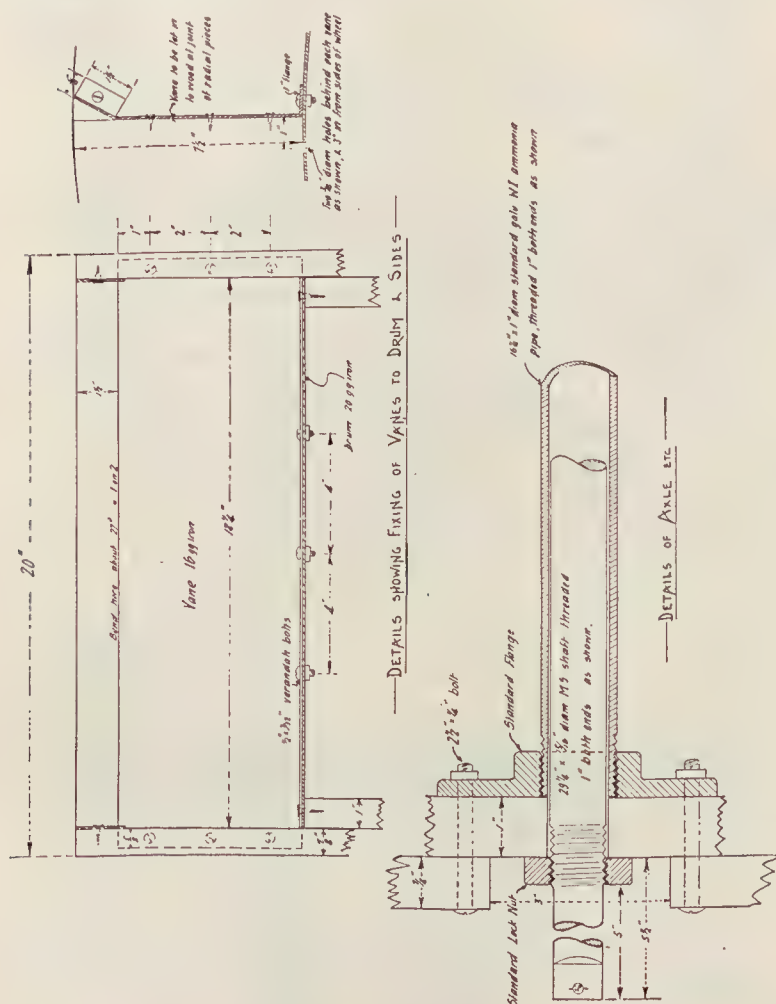
Plan of Water Meter for Measuring Water used in Irrigating Grove in which investigations were carried out at Tresco.

3. Tresco, a comparatively recent settlement, was established in 1913 on Mallee country, 14 miles south of Swan Hill, by Australian Farms Limited.

4. There is sufficient evidence to show that the salinity of the irrigation water was frequently excessive in the early years.

5. The construction of the main channels and the methods of applying water to the individual groves were in general very faulty and conduced to over-watering with consequent seepage troubles.

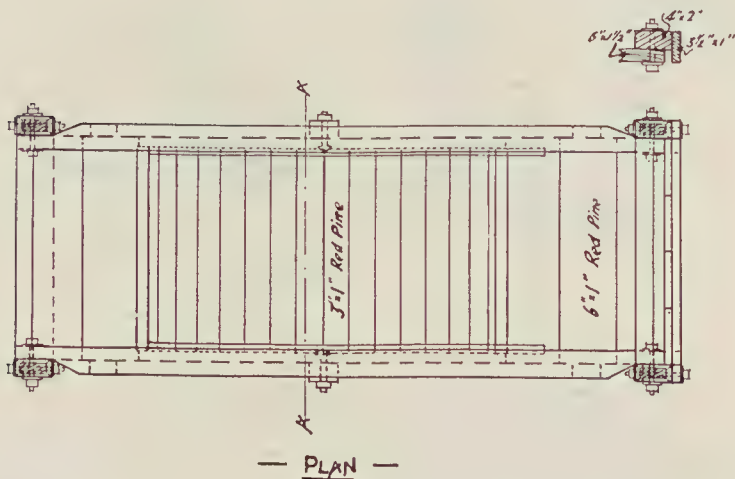
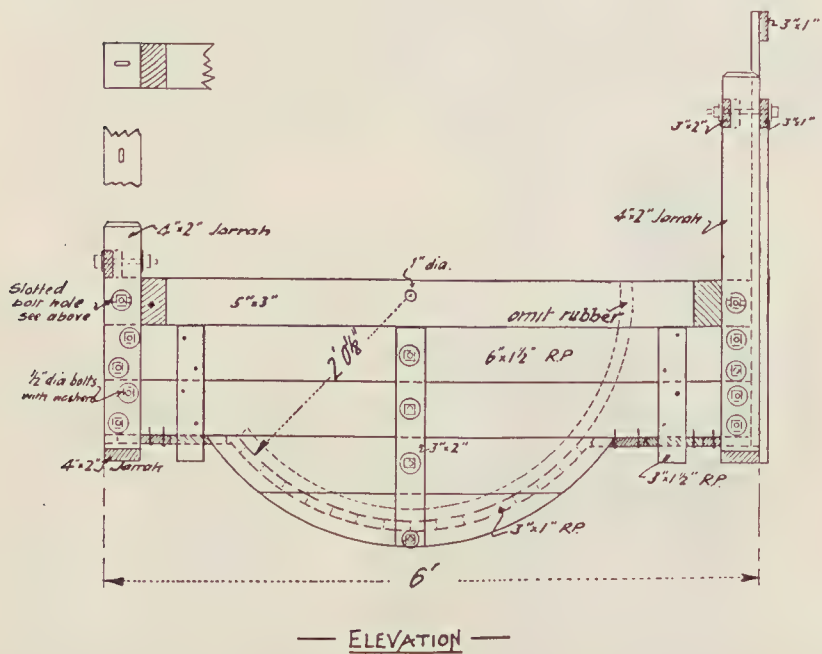
6. In September, 1925, the Victorian Irrigation Research Committee appointed a sub-committee to investigate the position of the settlement, and attempt reclamation.



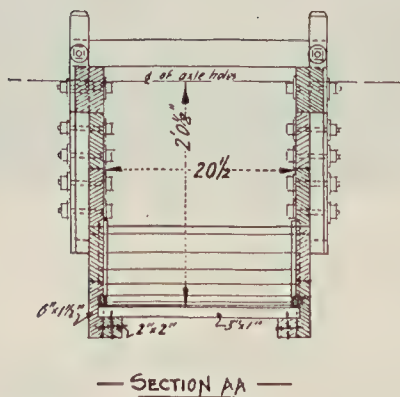
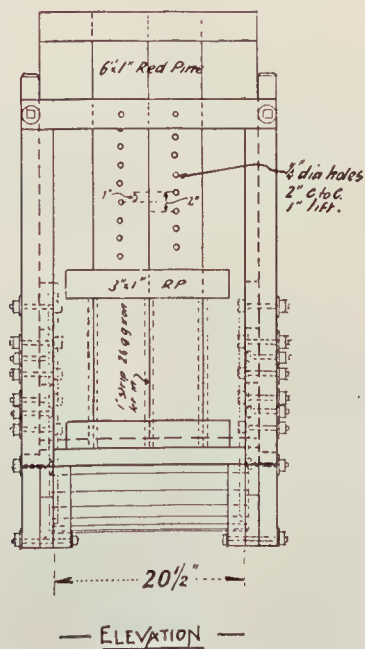
Details of Parts of Plan of Meter illustrated on opposite page.

7. Preliminary surveys confirmed the belief that the death of the trees was largely due to saline and alkaline soils. The symptoms were typical.

8. Cases of defoliation, following picking of the crop, were not infrequent, and point to the desirability of this operation being carried out if possible in cool weather.



Plan of Case for Water Meter



illustrated on pages 84-85.

9. No conclusive evidence as to the degrees of susceptibility of the different types of citrus fruits, or of the various stocks, was obtainable.

10. Drainage, as practised, was seen to be an inadequate preventive to the trouble.

11. Two distinct types of surface soil were noted. One, a red-sandy type, on which most of the remaining good groves occurred; and the other, a greyish-red heavier sandy loam type, often of poor tilth, whereon the trouble was first to appear, and on which, at the time of the investigation, no good groves occurred.

12. A. Sloane's grove, of the second type, and on which two-thirds of the trees were affected, was taken over for the purpose of carrying out field experiments.

13. An investigation of the effects of excessively long furrows in irrigating this soil is described and discussed. The conclusion is reached that the consequent over-watering of the land nearer to the head ditch is very harmful.

14. Short runs of 3 to 4 chains are compared with the long ones and are recommended for general use.

15. If a grower cannot afford concrete ditches he is advised to reduce the length of run by the use of earthen ditches, from which seepage need not be excessive.

16. A change of grade in any run usually results in unequal watering, and an extra ditch should be constructed at the junction of the two grades.

17. A high surface concentration of chlorine occurred on the affected groves; and it appeared that healthy trees could not be maintained where the average for the top 4 feet exceeded 21 parts of chlorine—i.e., 34 parts of common salt per 100,000 of dry soil, with a maximum concentration of 29 of chlorine, or 47 of common salt in any 1 foot.

18. An experiment is described which shows that, while furrow irrigation encourages surface accumulations of salt, flood irrigation can greatly reduce the concentration.

19. The method of flood irrigation practised is described.

20. For efficient watering a properly-constructed head ditch is essential.

APPENDIX.

The Water-measuring Wheel.

For the benefit of other workers who may desire to use a very accurate means of measuring water within the limits of about $\frac{1}{4}$ to $1\frac{1}{2}$ cusecs., the plans of the water-wheel used in these experiments are reproduced. A photo of the wheel and box is shown in Figure 6. The general design is the work of the late Mr. Commissioner J. S. Dethridge, and it was adapted to the special requirements by Mr. S. W. Rogerson, of the State Rivers and Water Supply Commission.

In its calibration (see page 90), it was shown that its output per revolution is 11.25 cubic feet within the range mentioned, and that its maximum error appears to be 1 per cent.

It will be found desirable to screen the water above the wheel to exclude rubbish. This may be done by letting into the concrete channel,



Fig. 6.—The Water Wheel and Box being Tested at Werribee by Mr. S. W. Rogerson, of the State Rivers and Water Supply Commission, prior to its installation at Tresco.

during its construction, wire-netting strips—one of 2 inches, and a second of half an inch diameter. At Tresco, too, a sand trap was necessary in which any earthy material, washed along the bed of the channel, could be caught so as to prevent its settling in the box.

With these precautions observed the wheel will be found to give little trouble. Any small cyclometer will serve to count the revolutions.

STATE RIVERS AND WATER SUPPLY COMMISSION.

WATER MEASUREMENT AT METER TESTING PLANT, WERRIBEE, 1.11.1926.

WHEEL FOR AGRICULTURAL DEPARTMENT RESEARCH WORK AT TRESCO.

Adopted size of Meter = - REV. = $11\frac{1}{4}$ cubic feet.

Number of Test.	Rate of Flow in Acre Feet per Day of 24 Hours.	Head Above Wheel.	Head Below Wheel.	Difference of Head.	Number of Revolutions.	Total Disc into Measuring Tank in Cubic Feet.	Discharge per Revolution.	Error per cent.	Remarks.
1	.28	in. $2\frac{1}{2}$	in. 1	in. $1\frac{1}{4}$	in. 5	.66-.66	Cubic Feet. 13.33	+ 18.5	Flow too small for accurate registration
2	(.3 cusecs)	3	$1\frac{1}{4}$	$1\frac{3}{4}$	10	113.625	11.36	1	
3	.8	$3\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{4}$	10	112.615	11.26	Nil	
4	.94	$3\frac{1}{2}$	$1\frac{1}{4}$	2	10	113.625	11.36	1	
5	1.2	4	$1\frac{3}{4}$	$2\frac{1}{4}$	10	113.625	11.36	1	
6	1.42	$4\frac{1}{2}$	2	$2\frac{3}{4}$	10	111.625	11.16	.8	
7	1.92	$5\frac{1}{2}$	$2\frac{1}{4}$	3	10	112.11	11.21	.3	
8	(1.4 cusecs) 2.8	9	4	5	10	113.625	11.36	1	About maximum accurate flow wheel capable of discharging is 1.5 cusecs
9	.86	$6\frac{1}{2}$	6	$\frac{3}{4}$	10	118.675	11.86	5.3	
10	1.12	$7\frac{1}{2}$	$6\frac{1}{4}$	1	10	117.665	11.76	4.5	Water backed up below wheel, i.e., wheel flooded
11	1.52	8	$6\frac{1}{2}$	$1\frac{1}{2}$	10	116.15	11.61	3.2	
12	1.72	$8\frac{1}{2}$	7	$1\frac{1}{4}$	10	112.615	11.26	Nil	Unsatisfactory condition

MARKETING MEAT IN LONDON.

By R. Crowe, Exports Superintendent.

It is always interesting to review the prices received from time to time for any commodity, and endeavour to find reasons for any variations which have taken place.

Some little time since, I was looking through the prices which lamb, mutton, and beef had realized in London during the last seven years at that period of the year when Australian meat chiefly comes on to the market.

Prices of Lamb, Mutton, and Beef.

With regard to lamb, prices were very high five years ago, but the year following a pronounced drop in values took place. During the last three seasons prices have been almost on the same level. This season shows a decline in values of about $\frac{1}{3}$ d. per lb.—speaking in a general way—but prices improved by $\frac{1}{3}$ d. per lb. towards the end of December, and that improvement was maintained during January.

The prices for mutton five years ago were high, but the following year they fell. Three years ago prices were comparatively low, and for the last two seasons they have been about on a level. This season there has been a recovery, and as the season has advanced prices have improved.

A comparison of beef prices is also interesting. For some years following the War very low prices were received. These improved during the seasons of 1924, 1925, and 1926, but declined three years ago. For the last two years they have been on about the same level. This year there has been quite a distinct improvement in price. Australian hind-quarters have recently been quoted as high as $6\frac{1}{2}$ d. per lb., and crops up to 5d.; these are, of course, for best quality frozen beef.

It will be recognized that there is a vast difference to both producers and shippers in the prices mentioned, as compared with 4d. per lb. for hind-quarters and 3d. for crops, which obtained eight or nine years ago. When one remembers that from the selling price the cost of slaughtering, freezing, storage, shipment, handling, and selling at the other end has to be deducted, the extent to which producers benefit by the higher prices may be realized.

Victoria is more directly interested in the export of lamb than in the export of either mutton or beef, and producers know that this season's comparatively low prices have been due to the reduced value of skins in consequence of the drop in price of wool as well as to the fall in carcass value.

I dare say that the changing prices for lamb and beef are, after all, only an evidence of changes that have naturally and gradually taken place. A number of years ago, the world's market price for beef reached such a low level that beef production became comparatively unprofitable. When prices for any commodity are low in Great Britain, the position is reflected in all countries which export to that market.

Argentina seemed to maintain her peak beef production longer than any other country, though we know now that the raising of beef has to some extent given way to wheat-growing, dairying, and sheep-farming. It, however, takes several years for cattle to diminish to such an extent that the grazing land may be used for other purposes.

The exports of beef from Argentina to the United Kingdom have gradually declined, until now they are 735,000 quarters (equal to 183,750 carcasses) less than in 1927. During the last four years the lamb exports from Argentina to the United Kingdom have increased by about 2,250,000 carcasses.

What is the Type of Lamb Required for Export?

The thought arising out of the situation which has developed, both in regard to supplies and prices, is: What can be done to better our position in future?

On account of the drop in the price of wool, considerably more attention will be given to the production of lamb for export. It is known that steps have already been taken in this direction. It is evident that those concerned will be well advised to produce the type of lamb which is most in demand and consequently brings the highest prices. Mr. Browning, of Yarrawonga, visited the Smithfield Markets in London in 1924. As the result of exhaustive inquiries, he, upon his return, purchased Southdown rams to mate with crossbred ewes. Since then he has exported lambs each year which have attracted special attention at the Smithfield Market, and which this season realized $\frac{3}{4}$ d. per lb. over the highest current rate.

Lamb of the type, weight, and condition most in demand always commands a preference on the market. New Zealand has, for many years, recognized this and catered for requirements accordingly; hence, lamb from that country commands top prices. Although Australia comes next, the relative prices indicate that there is still considerable room here for improvement. Reports, at times, show that poor quality lambs from Australia have to compete on the market with lambs from South America, and the result is a reduction in the price of the Australian article.

Should Beef be Chilled or Frozen?

A shipment of prime young beef was recently made from Victoria. The cattle were bred and reared at the farm of the Melbourne and Metropolitan Board of Works at Werribee. They comprised Aberdeen-Angus, Hereford, and Shorthorn breeds respectively, and were exhibited at the Royal Show last September, when they were in splendid condition. Under the auspices of the Meat Preservation Committee of the Council of Scientific and Industrial Research, it was arranged to ship this prime young beef as an experiment, to ascertain whether the preference given to chilled beef, as compared with frozen, on the English market, was due to a quality in the beef itself rather than to any superiority of the chilling process over freezing. No such test with beef from this country had been previously made, but it was known that the chilling of beef in Argentina was confined solely to prime young beef, and that any beef, although young, which was not prime, was frozen. All beef from cattle above a certain age is also frozen, even though it may be prime.

Duplicate sides of the beef with which the experiment was made were kept here. Some parts were chilled and some frozen, and later members of the Committee tasted portions of both the chilled and frozen lots, and were unable to detect any difference between them.

In London a large committee, representative of the various meat interests in Great Britain, tasted the meat after cooking, together with good Scotch beef, and Argentina chilled beef. The guests awarded first preference to the Australian frozen beef, second to fresh Scotch, and third to the Argentina chilled. Comprehensive tests were also carried out by Lyons, the well-known London caterers. This firm's test gave first preference to prime Scotch, the next in order of merit was Australian, and third, Argentina. The ordinary Australian frozen beef was also compared in Lyons's test, and was placed lowest on the list. Special reference was made to the superior quality of the beef from the Angus and Hereford breeds of cattle.

These results seem to prove that it is the *quality* of beef which is the main consideration, and that, if prime young beef could be shipped instead of beef from older bullocks, higher prices would be secured, notwithstanding the fact that it was frozen and carried in a frozen condition. It is known that there are practical difficulties in the way, particularly in Queensland, from where most of the Australian export beef is shipped. Unfavorable seasons are experienced, and many cattle have to be carried on for a year, or perhaps two, longer than is desirable, in order to get them into the required condition for slaughter. Again, in Queensland, there are difficulties in the way of freshening cattle on suitable pasture after they have been droved and railed for long distances to the abattoirs at ports.

Prospects of the Beef Export Trade.

Another side of the beef question may be referred to: For some time past it has been known that the shortage of beef cattle in the United States of America has become more and more pronounced. There were 68,000,000 head there in 1920, but the total has now dropped to 55,000,000. Production has not kept pace with the increase in population and consequent greater demand. Consumers have had to resort to pork and poultry, until now there is a general beef hunger. It is expected that some day the United States of America will agree to the importation of supplies from South America. "Such an event has already been forecast by President Hoover. If it happens, the price of beef will advance the world over, for then some of the supplies, which otherwise would go to Great Britain, will be diverted to the United States of America, with the result that there will be a world-increase in the price of beef.

It may seem to some that the contingencies referred to as affecting the price of beef are remote; all the same the prices obtainable here in Victoria are influenced by these considerations. During the last year or two the market price of fat cattle at Newmarket depended, to some extent, upon the price at which Queensland chilled beef could be landed in Melbourne. And the value of that, in turn, is dependent upon its value for shipment to London from the Queensland ports.

During the last six months, 22,000 quarters of chilled beef were brought into the Melbourne market from Queensland, together with large quantities of meat under other headings, such as briskets, rumps, and loins, butts, tongues, &c., &c.

Summarized, the position appears to be that, for some years to come, there will be an abundance—perhaps a super-abundance—of lamb and mutton available for consumption, and there is little likelihood of prices improving. Indeed, there is a danger of a lower price level being reached. The best means of meeting such a development would be by breeding quick-maturing lambs, of the type, condition, and weight preferred on the markets to be catered for.

The present prospect for beef appears to be good; one might be safe in saying particularly bright, and not only for the present, but for a long time to come. Therefore breeders would be justified in arranging for the production of prime young beef; this involves the giving of more attention generally to an improvement in the breed of beef cattle.

THE CARE OF CREAM.

R. T. McKenzie, Senior Dairy Supervisor.

Many of the defects of cream arise through lack of proper cleansing of dairy utensils. Too few dairy farms are properly equipped with facilities to provide an adequate supply of boiling water. Boiling water is one of the dairyman's best friends, for it not only cleans utensils, but renders innocuous those germs responsible for much of the contamination of cream. Instances come under notice at times where farmers apparently wash all their milk utensils properly, yet the cream is being graded at the butter factory. It cannot be too strongly emphasized that merely cloth or brush cleaning will not remove harmful bacteria from milk utensils; boiling water or steam is essential. All farmers may not be in a position to install a steam plant, but it is within the reach of all to provide a copper adjacent to the dairy which will give a reasonably adequate supply of boiling water for cleansing purposes.

The object in cleansing is to get rid of the micro-organisms, and as these are usually contained in dirt, the first step is to secure the removal of the facilities of propagation; the cleansing of utensils is, therefore, best effected by first rinsing them in cold or warm but not hot water, after which they should be scrubbed with a brush inside and out in hot water to which has been added washing soda or some such cleansing agent. The washing soda emulsifies the grease and aids in its removal. The reason hot water is not first used is that it will make the albumen of the milk stick tenaciously, and give the tinware a mottled and scaly appearance. The cleansing process should always be finished with a thorough rinsing, and scalding with boiling water. Where steam is available, all utensils should be put over a steam jet. It is important to remember that after they are so cleaned, all reasonable care must be taken so as to prevent their recontamination; they should therefore be stored in a clean place unexposed to dust and flies.

Cleaning Milking Machines.

Milking by machine is now very common, and may constitute a definite economic gain, for where a machine is installed two people can efficiently milk 50 cows or more. The effect on the production of a choice cream, however, is an important consideration, so that while mechanical milking may facilitate economic production it is fraught with a positive bacterial danger that does not apply to hand-milking. There is the liability of the teat-cups being soiled by dirty hands, they may drop off the teats on to a dirty floor and be replaced without being washed, and the inaccessibility of certain parts, such as inflations, rubber milk tubes, pipes, &c., may lead to their being imperfectly cleansed.

It is a significant fact that a lot of the faulty cream complained of at the butter factories is coming from farmers where milking machines are installed. Nevertheless, the caustic soda and boiling water method of cleaning machines is most efficacious, and there is no reason, with its general use, why a choice cream should not be produced.

No doubt there are other effective methods, but this process has the advantage of being quick and simple, and will not harm the rubbers or teat-cups, provided the caustic solution is immediately flushed off with boiling water. Briefly, the system is as follows:—(1) Before milking, draw clean cold water through the teat-cups and milk-tubes to the releaser; the object of this is to prevent adhesion of the milk. (2) Directly after milking, wash all loose dirt off the claws, then draw through each unit some cold or warm water so as to flush out the milk system. When the water is being drawn through the unit farthest from the releaser, insert a ball of horsehair in the end of the milk line to be drawn through to the releaser. (3) Through each set of teat-cups draw not less than one gallon of boiling water to which has been added caustic soda at the rate of one and a half tablespoonsful to four gallons of boiling water. (4) Immediately follow this by flushing out with boiling water (one gallon to each unit). This not only washes out the caustic solution, but helps to dry the rubbers and tubing. Remove the plugs or open flaps of milk line to allow circulation of air. (6) Clean the vacuum system in the same manner as recommended for the milk system. After the engine has been stopped dismantle the releaser and put it in a clean dry place.

It should, of course, be understood that it is essential that no milking machine is safe unless it is frequently dismantled for washing in detail. Indeed, with so much depending on the quality of cream—our export trade in particular—anything less than a daily dismantling of a machine and a thorough washing and drying of all the parts involves a risk.

A leaflet giving full details of the method of cleaning milking machines has been issued by the Department of Agriculture, and it can be had on application.

The Production of Choice Cream.

To ensure a choice cream, the following essentials should be observed:—

(1) The dairy premises and their surroundings must be kept clean and tidy.

(2) Milkers should wash their hands before milking each cow, and cows' udders must be cleansed before milking.

(3) Cream must be cooled, and removed immediately after separating to cream room.

(4) An adequate supply of boiling water must be at hand for washing utensils.

(5) Utensils must be thoroughly washed and sterilized so that they are self-drying, and must be kept in a clean, dry place.

(6) Cream should be delivered frequently to factory.

The following are some of the principal flavours in cream, their symptoms, their causes, and the remedial measures required:—

(1) *Stale*.—(Too old.) This flavour is caused by holding the cream so long on the farm that it becomes over-ripe; or it may be caused by the use of old and badly-cleansed utensils. The remedy is obvious: use sound clean utensils; cool the cream as it comes from the separator, and forward it frequently to the factory.

(2) *Fermented*.—The cream is full of gas holes, and rises as if yeast had been added; it may at times overflow the can. Fermentation is caused by the incursion of living organisms, accentuated sometimes by foul separators and milking machines, or by mixing hot and cold cream. This fault can be prevented by the proper washing and scalding of all utensils, milking machines, &c.; by cooling off cream before mixing, and by storing it in a cool clean room whilst awaiting delivery.

(3) *Metallic*.—(Cream tasting of metal.) This taint is caused by rusty cans or by the milk coming in contact with any rusty vessel. Only sound, well-tinned seamless cans and buckets should be used. Kerosene or petrol tins should never be made into milk or cream containers.

(4) *Mouldy*.—(Showing a hairy bluish mould on the surface of the cream.) This trouble is usually caused by keeping the cream in an ill-ventilated, damp, and consequently mouldy dairy, or with other food-stuffs, such as jams, preserves, &c., that are susceptible to mould growths. The addition of inferior preservatives may be a predisposing cause. (No preservatives of any kind should be added.) To prevent this taint, ensure free air-circulation in the dairy; refrain from storing any other foodstuffs in proximity to cream. The dairy should be given a coat of limewash.

(5) *Rancid*.—(Having a rank, pungent smell.) This is caused through decomposition (either by a specific organism or by an alkali such as washing soda) releasing the butyric acid of the butter fat. Neglect to cool cream and holding it too long before delivery all accentuate this bad fault. Its correction obviously lies in cooling the cream as it comes from the separator, in the thorough cleansing of utensils, and by frequent delivery to the factory.

(6) *Heated*.—(Heat permeating the butter fat.) This is caused by exposure to heat, either by storing or standing cream in the sun or by carrying it in an open vehicle without a cover. Cream at all times should be stored under as cool conditions as possible, and delivered to the factory protected from the hot rays of the sun.

(7) *Sour or Acid*.—The cream has a sharp sour or acid taste. The causes are skimming too thin, and the reprehensible practice of keeping skim milk buckets or barrels in the dairy. Change screw on cream separator to give 40 per cent. to 45 per cent. of butter fat, and do not leave sour skim milk near cream.

(8) *Ropy or Stringy*.—Elastic and lifting in strings. Ropiness is caused by a slime-producing organism gaining access mainly through the water supply. The cows should not be allowed entry to stagnant water. Where ropiness is giving trouble, thorough sterilization of the utensils with boiling water is absolutely indispensable. Ropiness sometimes has its origin in a diseased udder. Milk from any animal suffering from mastitis should not be used.

(9) *Weedy*.—(Harbouring of flavours from foodstuffs.) This taint is caused by allowing the cows to pasture unduly on rank succulent fodder, such as lucerne, trefoil, clovers, rape, and the like. This trouble is minimized by aerating the cream. This may be done by using the Lawrence or wash-board type of cooler to cool the cream as it comes from the separator; this allows it to flow over a broad enough surface to release the volatile gases. A wise precaution is to remove the cows from the offending rank pasture some time before milking. If pasture is cut and allowed to wilt, the danger of its tainting the cream is very greatly lessened.

(10) *Musty*.—(Having a woody flavour.) Keeping cream in an ill-ventilated dark room with decaying timbers, or in proximity to lumber, will give cream this flavour. The cream storage room should be well lighted and ventilated; wooden floors should be avoided and the room kept free of rubbish.

(11) *Tallowy*.—(Tasting and smelling like tallow.) It is generally agreed that cream which is too thick as it comes from the separator is susceptible to this flavour. Other causes are contact with copper, neglect to wash separator each time after use, using water containing slime from a separator bowl for washing other tinware, and neglect to scald utensils properly, the storing of rabbit skins, sheep skins, or bacon in close contact with cream. The remedy will be found in using only well tinned utensils, separating cream thinner, properly scalding utensils, and keeping foreign matter out of dairy.

(12) *Oily*.—(Impregnated with the flavour and smell of petrol, kerosene exhaust fumes, or machine oil.) Cream will soon take up the flavours of the above-mentioned if stored in contact with them. The water from the petrol engine hopper should never be used on dairy utensils. The exhaust fumes from the engine should be carried through the wall or roof (the wall for preference if rain water from roof is used for any purpose). Contamination sometimes occurs through careless use of kerosene when it is being applied to the udder of a cow affected with mastitis. Kerosene or petrol tins should not be used for holding cream.

(13) *Curdy or Cheesy*.—(Tasting like bad cheese.) This fault denotes the breaking up of the non-fatty solids; the fat separates and the albuminoids coagulate, leaving particles of curd. This is generally caused by allowing cream to become too old and acid before churning, and is contributed to by separating too thin and not stirring cream frequently enough. The remedy is therefore simple, viz., earlier delivery of cream, or, if necessary, the adjustment of cream screw and frequent stirring of cream to release the gases.

(14) *Cowdy*.—(Having an animal odour.) This trouble may be caused by the use of milk of a cow too soon after she has calved, or may be when she is near calving time. It may also be caused by leaving milk exposed

in a foul-smelling cowshed during the progress of milking, by the milker handling dirty stools or dung-fouled leg-ropes and subsequently failing to wash his hands. The milk from a newly-calved cow should not be used for the first five or six days, nor should the milk of any cow within eight weeks of calving be used. During the progress of milking, milk should be removed to the milk room after each cow is milked. Milk only from clean udders and with clean hands.

ANTHRAX.

(Synonyms: "Splenic Fever," "Malignant Pustule," "Wool Sorters' Disease," and "Gloss Anthrax.")

By R. Griffin, M.R.C.V.S., Veterinary Officer.

Anthrax is a disease that has been known from time immemorial, and is found in all latitudes and countries. It occurs epizootically amongst cattle, sheep, and horses; in fact, no animals are capable of resisting anthrax infection if conditions are favorable to its development. Human beings were formerly affected in large numbers; 60,000 are said to have died near Naples in 1617, and in 1770 15,000 deaths in San Domingo were attributed to the eating of meat of animals that had died of the disease.

In this age it does not appear epidemically in man, but cases occasionally occur amongst those engaged in tanneries, wool sheds, and slaughter yards, and some have been recorded as occurring from the use of shaving brushes made from the bristles of pigs that had died of anthrax.

The disease in man is usually termed "Malignant Pustule," and is generally localized, but if not properly attended to death will rapidly occur from septicaemia.

Cause.

The cause of the disease is the entry into the system of the bacillus *anthracis*, a rod-shaped bacillus that can be easily discerned through a microscope in blood drawn from animals affected with anthrax. The bacillus was first observed in the blood in 1848, but it was not till 1876 that Koch finally demonstrated that it was the cause of anthrax. The anthrax bacillus is aerobic, that is, it cannot live except in the presence of free oxygen. It increases in numbers by division, and so rapidly does this division take place that, in the course of a few hours, from the entry of the first bacillus, millions are found in the blood stream.

When the blood of an affected animal is exposed to the air, spores are formed, and these spores are most difficult to destroy. Koch states that they will survive after being five minutes in boiling water, but a solution of corrosive sublimate, one part to a thousand of water, will destroy them in a minute or two. These spores, escaping from carcasses of slaughtered animals and given off by living animals, are responsible for the spread of anthrax.

Method of Spread.

Anthrax is liable to occur at any season of the year when animals are pastured on infested lands. The infection may be brought in a variety of ways, e.g., sewage, water supply, infested hair or wool, by dogs or birds which have had access to an anthrax carcass. There are recorded cases of food stuffs and animal manures from the East carrying the germs of the disease. Anthrax may appear periodically in some districts—certain climatic conditions being apparently more favorable to the growth of the organism. Cases occur after heavy rains following a long dry period. It is held that worms will bring the spores of anthrax to the surface from the improperly-buried carcass of an animal that has died of the disease.

Modes of Infection.

Animals become affected with anthrax through the entry of the causative organism into the system by inhalation, ingestion, or direct inoculation. Infection through the lungs occurs when infected dust is inhaled; by ingestion when contaminated fodder is eaten, and through abrasions in the skin.

Men employed in slaughter yards, tanneries, and wool stores are most liable to become affected with anthrax.

Symptoms.

So rapidly does anthrax run its course that it is seldom the affected animals are even noticed to be sick. Observers have described the symptoms as follows:—In cattle, sheep, and horses the disease usually manifests itself in an acute form, and the symptoms are rarely characteristic of the specific affection. In some cases cerebral apoplexy is noticed, whilst in others the disease commences with excitement, which soon passes to depression. Temperature will be abnormally high—108 degrees to 110 degrees F. Respiration seems laboured; visible mucous membranes become bluish. As already stated, these symptoms are rarely seen; usually the animal is found dead, greatly swollen, and with a bloody exudate from the external openings.

Diagnosis.

A correct diagnosis can be arrived at only by a microscopical examination of blood from dead animals. A blood smear can be made on a piece of glass, but for those who are not acquainted with making smears, the best method is to cut off an ear, place it in a sealed tin or an air-tight bottle and forward for microscopical examination.

Post-mortem Appearances.

On opening the carcass, it will be found that the blood is liquid black in colour and tarry in appearance. The spleen will be much larger than normal and very black in colour. All the abdominal organs will be

congested; the lymphatic glands enlarged. The black tarry state of the blood and enlarged spleen are characteristic of anthrax. In the case of horses and pigs the throat will be swollen, and a jelly-like material will be found under the skin.

Treatment.

Curative.—There is no recognized curative treatment.

Preventive.—If possible, stock should be removed from infested pasture. Should the state of the grass and the seasonable condition be suitable, burning off will be found very effective. All contact stock should be inoculated with a recognized vaccine.

Control.

Should an animal showing symptoms already described die, the local authority must be advised at once, and in no circumstances should the carcass be opened. Cut off an ear and place in a bottle for microscopical examination. If possible, the carcass should be completely burned where it lies; if that be impossible it should be buried intact in a hole not less than 6 feet deep and covered with fresh lime. All earth around where the carcass has lain, to a depth of 6 inches, should be removed and thrown with the carcass in the grave. The earth from which the surface has been removed should be covered with quick-lime. As already stated, cattle should, if possible, be removed from infested pasture, and a thorough investigation made as to the possible source of infection, whether by sewage, water, fodder, or an improperly-buried carcass, and the necessary precautions taken to prevent further outbreaks. If there is any suspicion of anthrax the skin should in no circumstances be removed from a carcass.

Sheep are sometimes infected with anthrax at shearing time. Prior to shearing all sheds and yards should be thoroughly cleaned and disinfected by spraying with one of the recognized disinfectants. All wounds made with the shears should be disinfected, and the shears also should be thoroughly disinfected at frequent intervals. The most reliable disinfectant is tincture of iodine.

RINGWORM.

By R. N. Wardle, B.V.Sc., Veterinary Officer.

This is a highly contagious skin disease caused by a minute fungus termed *trichophyton*, and may be transmitted from animals to man and vice versa.

The fungus vegetates in the hair follicles or roots and in the hair itself. Inflammation of the follicles occurs, and this results in loosening and loss of the hair; hair which does not fall out becomes very brittle and breaks off close to the skin.

The disease occurs most commonly in cattle—more often in young than in old stock.

Symptoms.

The characteristic signs are—

1. In the beginning, clearly defined round patches, either hairless or studded with broken hairs, and situated mostly on the head, neck, and extremities; they vary in size from that of a shilling to the size of the palm of the hand, and numbers of these patches may join together to form much larger areas.

2. Desquamation of the epidermis in the form of asbestos-like scales. In some cases swelling of the affected skin occurs, in consequence of which the area projects above the surface.

3. Vesicles, which burst and dry up to form thick crusts or scabs, which in adult cattle are of different colours and of leathery consistence, but in calves are whitish-grey, like bread-dough. Beneath the scab is a suppurating surface, which gradually heals, and when the scab falls off there remain scurfy areas on which the hair slowly grows again.

4. Extensive hairless areas on which the skin becomes thickened, scaly, and wrinkled.

The period of incubation, that is, the time between infection and visible outbreak of the disease, is from eight to fourteen days.

Treatment.

The first procedure is to prepare the affected areas for the application of the remedial treatment.

This is done by washing the parts with soft soap and a solution of 2 oz. washing soda to 1 pint water. Where the areas are covered by hard crusts or scabs, olive oil may be used to soften them so that they may be removed. Then to the affected areas thus cleansed various remedies may be applied, and those recommended are:—

(1) For isolated patches:—

Ointments of iodine, nitrate of mercury, or creolin.

Lotions.—Tincture of iodine; salicylic acid in methylated spirits, 1 in 10; sulphurous acid in glycerine, 1 in 3.

These should be used once or twice a day.

(2) For extensive infections:—

Scrub the affected parts with a watery solution of liquor *carbonis detergens*, 1 in 20, twice a week; or paint daily with a 2 per cent. solution of picric acid; or apply once or twice a solution of copper sulphate (bluestone), 4 oz. to 1 pint boiling water, and use fairly warm.

(3) Where the rings are near the eyes, use a solution of $\frac{1}{2}$ oz. hypochlorite of soda to 1 quart boiled water, and apply frequently.

It must be borne in mind that the most active fungi are to be found at the outer margin of affected areas, so that dressings should also be applied beyond the infected ring.

Attendants should wash in an antiseptic solution in order to prevent infection of the hands and arms.

In cases where the affected animals are unthrifty, a tonic may be necessary, and the one advised is *liquor arsenicalis*.

Dose for adult cattle is from $\frac{1}{2}$ to 1 oz.; for calves, from 1 to 4 drams. To be given once a day for a period of from seven to ten days, in water or food.

Prevention.

Sheds, such as calf pens, should be kept clean. Walls should be whitewashed with a wash containing a disinfectant such as cresol (1 part in 100).

Light and ventilation should be adequate.

Bedding should be clean, and renewed frequently.

Stabled animals should be groomed daily, and clothing should be kept clean, and well aired.

The animals themselves should be kept in a well nurtured condition, and bone-meal licks should be provided.

Control.

This is effected by:—

1. Isolating affected animals, and treating them as advised.
2. Cleansing and disinfecting their stalls or pens, clothing, and grooming utensils.
3. Destroying infected bedding by burning.
4. Instructing attendants respecting the contagious nature of the disease.

THE GOVERNMENT STANDARD HERD TEST.

ITS EFFECT ON THE DAIRYING INDUSTRY.

By A. J. Gill, Senior Herd Tester.

Dairying is the chief of the primary industries of this State; its annual value is more than ten and a half millions. Then there are minor industries frequently associated with it—the rearing of calves, steers, pigs, and poultry—the worth of which amounts to millions yearly.

In dairying there is an opportunity for development. Years ago, in a time of serious depression, the industry proved to be our country's salvation, and it may be that in the near future history will repeat itself. It should be quite possible during the next few years to raise the State's annual return from dairying by at least one-third, even should there be no increase in the number of cows in the State.

The Standard Herd Test has opened the eyes of our farmers to the value of good pure-bred stock, and to the value of testing. To the breeders, it has proved the value of careful selection and mating. It has shown the effect of line-breeding and inbreeding, how by selection characteristics may be intensified, and has proved again and again the value of the good, pure sire.

The test was first introduced in 1912. Prior to that, any testing that was done was mostly carried out by farmers themselves. At Colac, the manager and directors of the butter factory had established

a Herd Testing Association, and tested herds free of cost. Officers of the Department of Agriculture gave demonstrations in testing, and a large number of farmers purchased testing outfits and tested their cows, but the result did not make for much improvement. Certainly some useless cows were culled, but their places were often taken by useless heifers, for farmers did not know where to look for the good sires that could be relied upon to raise the production of the herd.

Testing a herd enables one to ascertain the low-producing cows, but testing alone is not the way to permanent improvement. There is only one method for bringing that about, and that is by using a good sire, and to be of any value a sire must be pure-bred. Not all pure-bred bulls will beget good milking stock. It is the increase in the yield of the progeny over that of the dams that proves a bull's worth.

When the Standard Herd Test was introduced, and breeders were asked to enter their herds, one of the conditions made it obligatory on any one entering a herd to submit all his pure-bred animals to test. But for this rule more herds would have been entered, for no doubt some people would have hoped that with the glory of the performance of a few good cows in their herds, they would have been able to sell to unsuspecting people the progeny of the duffers. By compelling them to test every individual cow in their herds, the culls were forced to the abattoirs, and the result was general herd improvement.

The test, when first introduced, was, I think, up to that time, the best system ever tried in any part of the world. May be that claim will be still allowed. I believe that at the present time in the State of Victoria more cows are being tested than in the remainder of the Commonwealth; this surely speaks well for the efficiency of Our Standard Herd Test.

Having brought some of our pure-bred herds to such a high standard, it must naturally follow that there will be a corresponding increase in the production of our mongrel and grade herds. An example was, on one occasion, given to me by a butter factory manager. He mentioned the case of a supplier whom he had tried to persuade to have his herd tested. The man refused, but said he would purchase a pure-bred bull from a tested herd. He did this, and in a few years his factory return had doubled. This is just one instance of good that has resulted from the standard herd test.

Possibilities of Improvement.

It is an unhappy truth that the average value of the butter-fat yielded by cows in Victoria is only £12 per year. Yet in some of the herds entered in last year's test there were several herds whose average yield was over £30 per cow, and in a couple of instances about £40 per cow. Since the test was first begun two cows have each produced over 800 lb. of butter-fat in nine months, worth £60. This gives some idea of the wonderful possibilities for improvement that exist.

If we could succeed in bringing all our pure-bred stock under test, and get rid of the useless cows, and build up our pure-bred herds from the best and highest-producing families, we would eventually be in the happy position of having all good pure-bred stock, and improvement in all our dairy herds would follow.

Stock improvement may be classed under two headings: Pure-bred stock improvement and general herd improvement. Before we can effect any lasting improvement in our general herds of grades and mongrels, we must first bring about an improvement in our pure-bred stock, so that sires will be available for years in those herds. All heifers in a herd contain 50 per cent. of the blood of the sire. So the blood of the bull will constitute at least half of the future herd, and when we grasp this fact, it is easy to understand the effect of a good bull. Testing has proved that the mating and selecting of heavy-producing families intensify that characteristic.

For instance, the progeny resulting from the mating of animals from families yielding 400 lb. of butter-fat would probably yield 450 or up to 500 lb., and so the improvement goes on. If we take a bull from this mating, and he is capable of siring cows yielding up to 450 lb. yearly, we could use him on a herd of grades or mongrels capable of producing only 150 lb. of butter-fat.

Each heifer from this mating should be equal to two of the dams in an earning capacity. However, with mongrel and grade cows we would probably not get such good results, and it would probably take two crosses to double the production, because when dealing with mongrel blood and grades it seems difficult to overcome the tendency for reversion, and there would be a certain percentage of duffers. But the purer the blood becomes, the surer will be the improvement of the progeny.

We may sometimes hear a man say he prefers cross-bred or grades; that they are better than pure-breds. Statements of this sort show a pitiable ignorance of breeding and testing, and usually come from one who is a failure. It is only the 50 per cent. pure blood that makes the cross-bred profitable; the 75 per cent. that has improved the grade. The only hope for improvement lies in the pure-bred tested animal.

Breeders develop certain characteristics in their stock, but the only cows of use to the dairy farmer are those in which the characteristic of heavy milk production is fixed. Bulls capable of begetting such animals—bulls that are the progeny of animals that have produced from 400 to 700 lb. butter-fat in nine months—are now available from herds that have been built up after years of testing and culling.

The Federal Government has assisted by subsidizing Herd Test Associations, but these are for grades and general herds. It is a very good work, but the main and most important issue is the testing of pure stock, the providing of good sires, for without those no permanent improvement can be looked for.

There are wonderful opportunities for increasing production through the Government Standard Herd Test. Improvement can come only through sires whose worth is known, and it is only by testing that one knows which cows' progeny will be of most value. As our population increases and holdings become smaller, so more and more will we depend on the dairying industry. That industry has been improved by the Standard Herd Test, and will continue to improve it as the years go by. It is very doubtful if it is possible to find a more profitable investment for Government money than that devoted to conducting the Government Standard Herd Test.

EMPIRE PIG PRODUCTION AND MARKETING.

Report of the Imperial Economic Committee.

In the last report of the Imperial Economic Committee it is stated that during the last four years interest in Empire trade has intensified; at the same time interest in voluntary preference has consequently increased, and we may say that voluntary preference has become an accepted policy.

The readiness of the consumer to discriminate in favour of Empire produce demands a corresponding efficiency on the part of the Empire producer. There is no denying the fact that certain foreign countries have, through efficiency of marketing and production, attained a very strong position in the British market, and as the producers throughout the Empire become more efficient those in possession of the market will redouble their efforts to retain their hold. This must, even to the most casual observer, indicate the essential need for the organization of producers on a thoroughly sound and efficient basis capable of expanding. There is no safety in the mere foothold.

Agricultural development of the Empire requires stable trade—not a gamble—a playing for a rise. The notion that the top of the market can be easily caught by in-and-out methods is false. In times of depression a certain reduction of stock is inevitable, but, if trade connexions are to be preserved and advantages of rises obtained, the product must never be out of the market. In the long run, those who have stable trade connexions and remain persistently in the trade will on the average reap the greater profit.

The fluctuations in price and production are beyond the control of farmers in any part of the Empire. They occur in all countries to a greater or lesser extent. The Empire Marketing Board is now publishing regular information on the fruit and dairy produce trades, and it is recommended that similar work be undertaken in regard to the pig industry. This latter industry seems to offer great possibilities of development throughout the Empire, and the Committee has endeavoured to compile much valuable information on its development in different parts of the world.

Great Britain's Imports of Pig Products.

It is interesting to note that 90 years ago Great Britain was an exporter of pig meat. To-day she is dependent on overseas supplies for almost two-thirds of her requirements, and is the chief importing nation of pig products.

In 1927 the value of this import trade amounted to £54,500,000; of this amount £46,200,000 was expended in countries beyond the Empire. It is a striking fact that more than one-half this sum was expended in purchases from one country possessing few natural facilities, and so small that five of them could be placed in Victoria and still leave a considerable area. That Denmark has been able to secure such a huge trade is clear evidence of her efficiency and of the excellence of her organization.

Empire sources overseas contribute altogether less than one-seventh of the quantity. Hereunder is given the value (per head of the population of the countries concerned) of produce and manufactures exported in 1928 by the United Kingdom to the Dominions, to Denmark, and to the United States of America:—

				£	s.	d.
New Zealand	..	..	..	13	5	5
Irish Free State	..	..	..	11	17	7
Australia	..	..	..	8	17	3
Union of South Africa	..	..	..	4	2	2
Canada	..	..	..	3	12	0
Denmark	..	..	..	2	15	10
United States of America	..	..	..	0	7	9

At the outbreak of the war Great Britain was importing 8,500,000 cwt. of pig products, United States of America and Denmark each contributing over 40 per cent. of the bacon and hams, and Holland over 90 per cent. of the fresh pork. Some changes have, however, taken place during the last five years. Owing to the increasing consumption of bacon in the United States of America, that country's share of the bacon trade has diminished, to the advantage, for a time, of Denmark, Holland, Sweden, and the Baltic States. Some time since the outbreak in Europe of the foot and mouth disease caused Great Britain to place an embargo on the import of all fresh and refrigerated meat from Continental countries. One effect was to close the British market against the Dutch suppliers of fresh pork; this is now supplied chiefly from local and Irish sources. The measure has also led to an increase in the imports of frozen pork from the Dominions.

The trade of the two chief importing countries is in marked contrast. Whereas 90 per cent. of the pig products exported from Denmark consist of bacon, lard forms 69 per cent. of those sent out of the United States of America. Statistics show that while the industry in Denmark exists almost solely for export, that of the United States of America depends chiefly on its home market.

The British market for pig products, whether judged by the extent of supplies drawn from foreign sources or by its absolute growth in the last ten years, offers great possibilities to the Empire producer. But if he is to derive any benefit from voluntary preference by the consumer, the following facts must be taken into consideration. First, the products must be standardized; second, they must be of suitable quality; third, there must be regularity of supply; fourth, they must be organized so as to be able to compete with supplies from other countries.

The Sort of Bacon the World Requires.

Exporters must study and learn the likes and dislikes of their customers, and set themselves out to please.

A summary of differences in the requirements of various national markets is given in Messrs. Swift and Company's *Year-Book* 1927. It is interesting, and also forms a valuable object lesson. The English like their pork products lean, but the Germans like them fat. Germany is America's largest foreign lard purchaser. France and Italy import principally dry and salt pork. The Scandinavians are good customers for pickled pork and beef. The Belgians and the French buy a large proportion of our sausage exports. In the West

Indies and Central America the demand is for highly-seasoned sausages and hams. Some of the lard sent to these countries must be hard, and some soft; some must be cream-coloured and some white. Thus many countries mean many different tastes and fancies. It is not sufficient to produce a particular article—that article must be of the quality required and must be marketed in the manner required by the customer, and there must be a guarantee of continuity of supply.

In the United Kingdom there has been a general change in the kind of bacon and pork required by the public. To-day there is a demand for smaller and leaner cuts in place of the fat heavy joints. The lean type of bacon and ham and the small cuts of pork are now firmly established in favour throughout the South of England, as well as in the large towns and mining centres throughout the country.

In the Midlands there is a demand for a somewhat fatter article for sausages, pork pies, and processed meats; whilst farther north still fatter products find a ready market. All these differences are, however, relative. A demand for hard-cured bacon persists in some districts, but the general tendency throughout is for a leaner meat, whether it be bacon, hams, or pork.

The cuts in favour in various parts of the country also differ. Where the demand for the lean type is firmly established, the Wiltshire cut side holds the bacon trade. This is the form in which Danish bacon is imported into England. In the Midlands and North the Midland cut finds ready sale. This cut is somewhat similar to those in vogue in the United States of America. In the North there is a demand for rolled bacon, which is largely supplied from Scotland and Northern Ireland. Yet everywhere the demand for Wiltshire cut side is spreading. A knowledge of these requirements is a necessity, and catering for this market enjoins on the farmer the breeding of the correct type of pig to provide lean cuts and cuts of the correct size.

Again, the change in consumers' tastes is not solely one of preferring lean to fat bacon or pork, but also extends, in the case of bacon and hams, to the "cure." In place of the hard-cured article that could be left in the larder for weeks, the present demand is for a mild-cured type. Mild-cured bacon or ham does not keep so long as the hard-cured. A mild-cured bacon, therefore, entails on the curer greater attention to regularity and frequency in supply. Consequently he requires in turn a regular supply of pigs from the farmer.

The success of the Dane on the English market is due chiefly to the extent to which he has achieved regularity and frequency and uniformity of supply. This has been backed by an efficient selling organization supported by judicious advertisement.

Unfortunately, on farms the pig is usually relegated to a minor position and is regarded only as a means for utilizing the by-products and waste. This makes difficult the following of any consistent policy and compliance with requirements essential for success.

Live and carcass weights are given by the British Ministry for Agriculture as follows:—

Porkers.—Live weight, 90 to 100 lb.; approximate dead weight, 75 to 80 lb. This represents the prevalent demand in London, Smithfield, and in the South of England generally, also certain of the large towns.

Porkers.—Live weight, 100 to 125 lb.; approximate dead weight, 80 to 100 lb.

Cutters.—Live weight, 125 to 180 lb.; approximate dead weight, 100 to 140 lb.

Baconers are classed as follows:—

Sizeable.—Live weight, 180 to 240 lb.; approximate dead weight, 140 to 180 lb.

Stout.—Live weight, 240 to 270 lb.; approximate dead weight, 180 to 200 lb.

Overweights.—Live weight, 270 to 290 lb.; approximate dead weight, 200 to 210 lb.

Contracts between Danish curers and farmers specify carcass weights of between 132 and 158 lb., with deductions for any outside these limits, and a premium for special quality pigs, suitable for export, of carcass weights within the narrow limits of 139 to 150 lb. Danish production has become so standardized that the majority of the bacon exports consist of carcasses within this premium grade.

In addition to weight standards, the type conformation and general quality of the carcass are of all importance. The carcass must be of correct type. The type conformation and general quality of carcasses suited to the requirements of the pork, bacon, and ham trades are uniform. A statement which is of outstanding importance is the description which was prepared by a committee of bacon-curers and dealers in the wholesale pork trade, and which therefore gives authoritatively what they desire. It is too often assumed that different breeds or crosses are required to produce the animals best suited to the pork and bacon markets respectively. The fact that, in the opinion of those best qualified to judge, this is not the case removes a serious obstacle in the way of a consistent policy of production.

The Type of Pig Required.

There is no need to introduce further complications into pig production by requiring farmers to rear different types of pigs accordingly as they prefer to supply the pork or the bacon markets.

The farmer producing the type of carcass in greatest demand by the pork trade can, if that trade does not appear to be remunerative, keep them till they reach bacon weight.

The following are the requirements:—The carcass must be that of a properly fed castrated male or virgin female. The predominating colour should be white. The middle portion, from the first rib to the aitch bone, must be long. The head and shoulder must be light; ribs well sprung, they must clearly indicate where the back leaves off and the side begins. The line of back must be slightly arched from head to tail, and not dished nor humped over the shoulder. The neck must be of medium length, devoid of crest. The shoulders must be smooth and slightly rounded from side to side over the top and very compact. The back fat should be even, without pronounced thickening over the shoulder. It should taper slightly from the shoulder to the gammon,

and should fall within the following measurement at the shoulder according to weight:—

Dead weight—

60 to 100 lb.	..	..	up to $\frac{1}{2}$ inch.
100 to 130 lb.	..	..	$\frac{1}{2}$ to $\frac{3}{4}$ inch.
130 to 160 lb.	..	..	$\frac{3}{4}$ to $1\frac{1}{2}$ inch.
160 to 180 lb.	..	..	$1\frac{1}{2}$ to $1\frac{3}{4}$ inch.
180 to 210 lb.	..	..	$1\frac{3}{4}$ to 2 inch.

The underline must be straight and thick throughout and free from flabbiness. Thick lines or streaks of fat should be absent from the visible portion of the lean, and indications of lean must be visible between the ribs. The shanks should be short and the bone fine, fore hock and ham free from wrinkles. Flesh must be carried well around the bone, leaving no bareness inside the thigh and well down to knee and hock joints. The vertebrae must be of a flesh-pinky colour and flinty in texture. The proportion of fat to lean must be good; the fat should be perfectly white and firm to the touch. The texture of the flesh must be fine-grained and not rough or fibrous. There must be no excess of internal fat. The kidneys should have a thin covering of fat. The rind must be thin, flesh-coloured, perfectly smooth and pliable, free from deeply rooted bristles, and devoid of any skin pigmentation. There must be no indication of black bristles or of "seedy cut."

Such carcasses will be produced only as the result of selective breeding and proper feeding. Thus two factors are involved—breeding and feeding. On the question of breed the trade opinion is definite, and says, "The predominance of the pure-bred Large White boar, also known as the Large White Yorkshire, as the sire of the best commercial stock, both in this country and those supplying the home market, is unquestioned. There is no evidence, either at home or abroad, to show that boars of any other breed have been so widely adopted for the purpose of suiting the requirements of the English bacon and pork markets, and of providing producers with hardy and quickly-maturing stock." This is particularly interesting, owing to the efforts of a former officer of the Department of Agriculture, who for several years endeavoured and at last succeeded in persuading breeders to use the Large Yorkshire in order to improve the type of pig in Victoria. As this breed of pig is comparatively new to many farmers the following description will not be out of place:—

The boar should have a head showing masculinity, but must be free from coarseness; he should be light in the shoulder, long in the back, which should be slightly arched from head to tail; a full deep loin, and a long, well developed rump. The ribs should be well sprung, and then drop fairly straight, giving a smooth even side blending nicely with the shoulders and hind-quarters. Hams should be smooth and tapering without excessive bulging. Underline should be straight, the hair fine and silky; mane bristles must be absent. The legs should be short and straight, with strong, clean-cut bone; pasterns short and upright. General view:—Well ribbed up with good length, but at the

same time smooth and compact; straight lines top and bottom; light shoulders, good hams, short legs. Because a pig is a Large Yorkshire it does not mean that he is all that is required. The boar especially must be of correct type, with the desired characteristics. This is a point of special importance. While the Large Yorkshire breed is acknowledged as the best in all parts of the world, it is necessary to select within that breed. Some breeders lose sight of this, with the consequence that their animals quickly deteriorate. The Large Yorkshire may be crossed with the Berkshire, the British Black, the Wessex, and the Middle White. In some parts of the Empire, owing to climatic conditions, black breeds are preferred, but the pigmentation "seedy cut" which frequently appears in the fat of the female black pig depreciates the value of the bacon on the British market. The commercial advantage therefore lies, unless local conditions make that impossible, in establishing the Large White Yorkshire as the recognized sire, the resulting progeny being suitable for either pork or bacon.

The Pig Industry in Various Countries.

The pig is raised as an adjunct to general farming, chiefly in districts where the dominant farming products are respectively maize, potatoes, butter, and cheese. Examples of this may be seen in the United States of America, Germany, and Denmark.

Over two-fifths of the 51,000,000 pigs in the United States of America in 1926 were located in the five States forming the centre of the maize belt. It is estimated that between 30 and 40 per cent. of the maize produced in the whole of the United States of America is marketed in the form of pig flesh. Maize feeding favours the production of fat, and consequently breeds producing large weights are in favour on the maize belt. It is largely due to this association of pig-raising and maize cultivation that the United States of America is the largest exporter of lard in the world. It is also significant that United States bacon finds its chief market in the Midlands and North of England, where in some measure the taste for a fat product still lingers.

In Germany pig-raising is closely associated with potato cultivation; most of the pigs bred there are of the fat type. Denmark is the outstanding example of the linking of pig-breeding with butter-making. There separated milk and barley form the basis of the ration. This combination is specially suitable for the production of lean bacon, so much in demand in the United Kingdom.

The great need is for uniform type, and however ardently a protagonist may believe in the superiority of his particular fancy, the selection of breed must depend on market requirements. Concentration on a cross or breed that meets the demands of the market is undoubtedly preferable to diversity.

It is an astonishing fact, but proves the superiority of the English farmer as a stud-master, that though other countries are exporting pig products to England, breeders have to go there for their pure-bred stock. Export licences issued by the Ministry of Agriculture in

England and Wales, showed the following number exported in 1927 and 1928:—

—	Large White Yorkshire.	Middle White Yorkshire.	Berkshire.	Large Blacks.	Wessex.	Tam- worth.	Lincoln.	Total.
Boars ..	109	8	12	2	3	1	1	136
Sows ..	108	15	11	2	..	4	..	140
Total..	217	23	23	4	3	5	1	276

In order to assist and encourage the farmers in the use of good sires the Ministry of Agriculture for England and Wales makes grants. Only boars entered or accepted for entry on the *Herd-Book* are eligible for grants. The boars must be approved of by a Live Stock Officer.

Breeders providing boars are required, amongst other conditions, to guarantee service annually of at least twenty sows belonging to not less than ten owners. The scheme has been in operation for some years, and has proved beneficial to the small farmer, and there is a noticeable improvement in the stock in districts where the scheme is operating. The grant is one-third the estimated value or purchase-price of the boar; besides receiving this the owners are allowed to charge service fees.

The advisability of making differential grants in favour of the Large Whites is now being considered by the Ministry of Agriculture.

In 1928-29 premiums were granted to 917 boars of the following breeds:—

Berkshire	..	..	..	22
Cumberland	..	..	..	54
Gloucester Old Spots	..	..	..	6
Large Black	..	..	..	47
Large Whites	..	..	..	589
Lincoln Curly	..	..	..	27
Middle Whites	..	..	..	92
Large White Ulster	..	..	..	6
Wessex Saddleback	..	..	..	12
Welsh	..	..	..	4
Long White Lop Eared	..	..	..	58

Breeding and feeding are two factors of extreme importance in cheap production. Some Continental countries can produce, we are told, 1 lb. live weight for $3\frac{1}{4}$ lb. food. The amount required in England is nearer $4\frac{1}{2}$. The smallness of the quantity of the feed found necessary in European countries may be due to the system of litter testing and pig recording over a number of years, which has enabled careful selection of sows to be made, and now a type has been evolved which is prolific, healthy, and a "good doer." At the same time, testing and recording indicate clearly the farmers' deficiencies in management and feeding. This is a system that could profitably be carried out in Victoria. Every pig-breeder should test the value of different feeds by weighing his pigs regularly; until we do this we cannot hope to make much headway.

An interesting feature is the seasonal variation in the sale of pork in England; 85 per cent. of the year's supply is sold in the eight months from September to April. Many butchers handle no pork at all during the summer. There is no doubt that in the warm months people do not purchase pork to the same extent as in the colder portions of the year when prices are better. Here is a lesson for pork producers.

Payment on quality is also a factor that will help to bring about an improvement. In Denmark farmers are paid, not only according to weight, but also according to quality. Scottish curers complain that 50 per cent. of the pigs they receive are over weight, too fat, or of bad conformation. These deficiencies may be due in some cases to wrong breeding, but in most cases it is the result of faulty feeding. The rations are badly balanced, and it is estimated that fully a quarter of the separated and about three-quarters of the whey fed to pigs is really wasted.

This is an exceedingly interesting point, and one that deserves serious consideration in Australia. It must be borne in mind that the failure to balance a ration not only adds to the expense of feeding; it also produces an inferior article.

The Scottish bacon factories cater almost entirely for a special trade in what is termed Ayrshire rolls. For these, pigs are required which will give between 140 and 170 lb. dead weight, and will show an inch and a half of back fat, while the sides are fairly lean and long, similar to those required for Wiltshire bacon. In Ayrshire rolls the whole side, including the hams, is skinned and the bones are removed. When the carcass is cured, it is cut into quarters, which are rolled. The chief market lies in the Glasgow area.

In both England and Scotland there is a multiplicity of breeds. But in the North of Ireland the curers are not handicapped to the same extent. The majority of pigs belong to the Large White Ulster type. This pig possesses a thin skin and very deep side, and is considered in Ireland as especially suited for rolled bacon, a somewhat similar product to the Ayrshire roll, but distinguished from it by the removal of the hams and shoulders before curing. For the rolled bacon trade a pig giving from 168 to 196 lb. dead weight is desired. The markets for rolled bacon are chiefly round Glasgow and in Northern England. The Large White Ulster pig, though well suited for the specialized bacon trade, is not regarded as suited for Wiltshire sides. The maintenance of the quality of the Northern Ireland stock is assisted by the fact that the Ministry of Agriculture is making grants for premium boars. These are restricted to two breeds—Large White Ulster and Large White Yorkshire.

In the Irish Free State uniformity of type exists to a considerable degree. Breeders and feeders have been encouraged to produce lean meat, and for some time the use of the Large Yorkshire pig has been advised. The raising of fancy breeds, particularly the short chubby pig overloaded with fat, has been discouraged. The use of black pigs is opposed owing to their tendency to "seedy cut."

During 1925 to 1927 there was a shortage of sows in the poor districts, and the Government arranged for the distribution of a number of young sows of the Large White Yorkshire breed, and to-day the poorest districts are producing the pigs most suited for the factories.

We have long been told that the proof of the pudding is in the eating; no doubt the worth of bacon could be proved in the same practical way. That Canadian bacon deserves its reputation for uniformity and quality is indicated by the fact that the local yearly consumption averages 81 lb. per head of population. To-day three-fourths of the Canadian pigs are either pure bred Large Yorkshires or animals in which there is Large Yorkshire blood.

Denmark's system of testing is an object lesson. A breeder who desires to enter a sow on the *Herd-Book* is required to produce four of her weaners from a single litter. When from six to eight weeks of age the weaners are taken to a testing station, where they are retained until they attain a live weight of approximately 200 lb. They are then sent to the bacon factory to be killed and dressed. From the factory a detailed report is supplied on the carcasses and on the resulting ham, bacon, &c. It is on this report that a decision is arrived at whether or not the dam's name is to be entered in the *Herd-Book*.

In Denmark continuous experiments are carried out with feeding combinations. It is, however, regarded as an accepted fact there that the combination of separated milk and barley meal cannot be beaten. In September, 1928, the average selling price for pigs six weeks old was £1 13s., and at eight weeks old £2 4s. The Large White York is crossed with the Landrace to produce the famous Danish bacon.

Sweden, too, has its pig-testing stations, and a valuable industry has been built up; the principal breeds are the Large White Yorkshire and Swedish Landrace. After various experiments the Large White Yorkshires have proved most suitable for the bacon trade, and consequently they constitute the chief breed in Sweden. The Swedish Landrace is not such a long animal as its Danish namesake, but it is hardy and produces big litters.

A Royal Agricultural Society in Sweden holds weekly live stock sales, arranges for the inspection by veterinary surgeons of stock intended for stud purposes, keeps herd-books, employs agricultural advisers to assist farmers; it makes loans to farmers, and arranges a half-yearly show of pure-bred pigs. Further, the society possesses a bacteriological laboratory which is conducted for the advancement of the pig industry. To carry out all this work, the society is given a large Government grant, and the amount of the annual subscription of members, of whom there are 12,000, is only 2s. 6d. --

Holland has also developed pig-farming and does a large export trade. The dominant breed there is the German Landrace; it is similar to the Danish, and it is claimed that the young mature quicker than do the Large Yorkshire. However, there are many other breeds farmed, and this diversity of type has proved a serious handicap in the development of the bacon trade. In Holland the utilization of pig offal has become a specialized trade, and is well organized. Soap is made from the offal fat; pig heads for brawn, and trotters are exported to Africa; the livers are sent to Germany. The products of one factory, for instance, besides bacon, preserved meats, and sausages, also include refined lard and other edible fats, salad oil, soap, and blood meal. But the most distinctive feature of the trade is the output of modern chemicals, such as insulin and other drugs.

The variations in the type and quality of pigs received by the factories form a source of complaint, and the Government has recently sent a committee to Denmark to study the methods there.

Denmark, Sweden, and Holland constitute a group of European producers with whom Empire industry will have to compete in the British market. The objectives of these three countries are regularity of supply, standardization of quality, and facility for identification by the consumer.

In the United States of America the immense pig industry built up is amazing. Bacon factories are departments of great meat-packing establishments which handle all kinds of stock. One firm, for instance, reports that the combined dressing capacity of its several plants is 3,000,000 cattle, 8,000,000 pigs, 5,000,000 sheep, 1,000,000 calves, or 57,000 animals every working day.

By-Product of the Industry.

Another well-known packer converts 40,000 pigs a day into pork and bacon. Such large-scale production enables full use to be made of by-products; this is especially important in the case of certain chemicals obtainable from very small animal glands. The smallness of these glands is indicated by the fact that 16,000 of them are required to make 1 lb. of insulin.

It is estimated that by-products form about one-fifth of the pig. The complete utilization of this one-fifth is regarded as one of the great assets of the American industry. To mention a few of the products:—The hair is used for upholstery; hearts and lean trimmings for sausages; tongues are canned; brains and kidneys are sold frozen; pepsin is derived from the stomach linings, the casings are used for sausage-skins, the intestines for chitterlings, and the spleen as fish-food; tails, snouts, and ears are converted into gelatin or glue; fat trimmings are melted into lard or grease; blood and hoofs are made into fertilizers.

In America less than a fifth of the full side is turned into bacon; the rest is marketed in the form of cuts, under specific trade-names; for example, the loins are used for pork chops, the shoulders for both steaks and roasts; shoulders cured and smoked are marketed as pic-nics; hams are sold under the name common with us; lower-priced cuts are described as fat-backs, clear plates, and spare ribs. Liverpool is the chief entry port for American pig products.

Prospects of Australian Export Trade.

From the Southern Hemisphere, New Zealand has commenced to develop an export trade in frozen pork. The distance to the Home market is a severe handicap, and renders the export of mild-cured bacon impracticable. Scientific investigation has shown that the deleterious results are due to the formation of large ice crystals at the time of freezing, which occurs at a considerably lower temperature than is required for the freezing of fresh meat, and these crystals cause the tissues to disintegrate.

In Victoria we have perhaps the most favorable conditions for the raising of pig products that exist in any part of the world. In the future we may be in a position to consider an export trade. At

present the local market absorbs all the bacon and ham produced here; the prices ruling are quite satisfactory, yet this may not be always so.

But if we wished to export, we are not in a position to supply any quantity of the right class of pork or bacon. The diversity of type and the great number of different breeds will prove a serious handicap to progress, and the in-and-out policy of many of our farmers would operate against a continuity of supply.

Only in one district in Victoria have I noticed a uniform type of pig. A general system of testing would be invaluable. Some farmers are doing this, but very few.

More attention to the balancing of our rations is essential. Balancing a ration not only means a saving of food; it also means the production of better pork and bacon. Payment by quality would bring about an improvement. The adoption of a uniform type of pig is very desirable. It is of no use breeding pigs unless they are of the class that will command a ready market. A similar type of animal will be found suitable whether required for fresh pork or for bacon.

The taste now is for a lean bacon, and also a lean pork. If our butchers would supply the quality of pork required much more would be used. But somehow they continue to display the same over-fat chubby porker that was in favour in our grandparents' time.

The same type is necessary whether an animal is to be killed as a porker or as a baconer.

ELMORE CROP AND FALLOW COMPETITION, 1929.

In his report on the crop and fallow competition conducted by the Elmore Agricultural and Pastoral Society, the judge, Mr. H. Formby, of Numurkah, states that it was interesting to note that the best crops were grown on the leading fallows of the previous year. Seventeen entries in all were inspected, only one entry being withdrawn. The rainfall for the growing period was only 440 points, and the dry season was reflected in the condition of the crops, which were of uneven growth generally. There was a noticeable absence of wild oats, and the crops were very true to type. Flag smut and take-all showed out as a big factor in decreasing the yields. Nabawa was the most outstanding wheat as regards yield and absence from disease, but as yet only small areas are grown. A crop of Free Gallipoli sown alongside Nabawa under the same conditions was badly affected with flag smut, while the Nabawa seemed to be quite free from disease. Major proved to be well headed and of strong growth, appearing to suit the district. Free Gallipoli and Ranee were the more favoured wheats and showed promising results, but flag smut was prevalent in these varieties even on newly farmed land. Federation and Currimp were unevenly headed and showed more take-all than other varieties. Copper carbonate and formalin were the most favoured methods of pickling seed, formalin predominating. Crops grown on the black soil showed signs of wilting, while red land on the same areas was not affected.

The Crops.

First place was secured by Mr. S. Crowe, whose crop of Free Gallipoli was well headed, grainy, true to type and fairly dense, but showing a few weeds. Sown with 75 lb. of seed and 100 lb. of super. per acre, it appeared to have made a good strike. Mr. D. J. Murphy, who was second, showed a nicely grown crop of Major, well headed, true to type, very free from weeds, but slightly uneven. It was sown with 66 lb. of formalin-pickled seed and 90 lb. of super. per acre.

The points allotted for crops, together with those of the fallows for the previous year, are shown in the following Table:—

Competitor.	Yield.	Type.	Absence of—		Even- ness.	Total Crop, 1929.	Total Fallow, 1928.	Aggre- gate Crop and Fallow.
			Disease.	Weeds.				
Possible Points	35	20	15	15	15	100	100	200
S. Crowe (a)	25	19	13	13	14	84	94	178
D. J. Murphy (c)	24	19	13	14	13	83	91	174
W. M. Murphy	24	19	13	14	12	82	91	173
J. J. Cheatley	21	19	13	15	14	82	91	173
D. J. Murphy (b)	22	19	14	14	12	81	92	173
D. J. Murphy (Carmody's) ..	23	19	12	14	13	81	92	173
A. T. Doebeil	25	18	14	14	11	82	90	172
S. Crowe (b)	23	18	13	12	13	79	91	170
D. J. Murphy (a)	17	20	14	14	14	79	90	169
T. Busst (b)	21	19	11	14	14	79	89	168
Dickens and Hayes	19	19	14	14	12	78	88	166
D. J. Treweek (Home)	18	19	12	14	13	76	88	164
Brown and Wright	18	19	14	13	12	76	88	164
R. R. Perks	18	17	13	13	13	74	90	164
D. J. Treweek (Hunter's)	20	19	14	12	13	78	82	160
D. D. Palmer	18	18	13	14	13	76	83	159
T. Busst (a)	15	18	12	13	13	71	83	154

The Fallows.

Eleven fallows were entered, but owing to the dry spring these were all shown in much the same condition, farmers following practically the same routine of working the fallows, although a divergence of opinion exists as to the best method of working. Very few weeds were showing. The early fallows proved to be in the best condition, and those worked with the scarifier or spring-tooth cultivator showed decidedly the best mulch, also more moisture content. Such working, while consolidating the mulch above the subsoil, also brought up a cloddy surface so desired by farmers in this district. Showers of rain in different parts of the district effected a slight difference in moisture content of entries.

Mr. Frank Crowe, who gained first place, showed a very fine paddock of red loam soil, the moisture content being good. An even mulch worked nicely in spite of the dry spring, cloddy on the surface and showing firmness towards the subsoil which held the moisture evenly. Cultivation had been carried out without being overdone. The paddock was ploughed in July, harrowed in September, rolled, spring-toothed, and again harrowed in October after showers.

Second place went to Mr. A. E. Doyle, whose fallow was ploughed with the skeleton board plough in June, harrowed in August, spike-rolled and twice harrowed. The fallow was evenly worked, and the moisture content was the best in the competition. A chocolate loam soil furthering out to patchy black soil.

Third place was taken by Mr. J. Gow, whose fallow was ploughed in June, harrowed twice immediately, scarified in August, and harrowed later. The moisture content was good, but slightly uneven. There was a good mulch brought up by careful working after showers, but packed rather more tightly than the first and second entries.

Detailed awards are as follow:—

Competitor.	Moisture.	Mulch	Absence of Weeds.	Cultivation.	Total.
Possible Points	25	25	25	25	100
F. Crowe	23	23	24	24	94
E. A. Doyle	24	23	24	22½	93½
J. Gow	23	23	24	23	93
D. D. Pamler	23	22	24	23	92
R. Perks	22	23	23	23	91
J. Trewick (1)	23	21	24	22	90
D. J. Trewick	22	21	23	23	89
J. Trewick (2)	21	22	24	22	89
D. J. Murphy	22	21	23	22	88
H. Carmody	21	22	23	22	88
T. Busst	21	20	24	22	87

PATCHEWOLLOCK AND BARING CROP AND FALLOW COMPETITION, 1929.

Report of the Judge, A. L. McGregor, Walpeup.

The rainfall for these districts, although slightly more than in the districts to the north, was still much below the average. The rainfall up to the time of judging was in the vicinity of 5 inches. Most of the crops inspected were of a high standard, considering the season. Several competitors on heavy land had withdrawn their crops from the competition, including the first prize fallow from last year. In almost all instances the crops on heavy land were a total failure. Takeall was fairly prevalent, and flag smut very bad; the latter was very noticeable in the Free Gallipoli. The sowing of large areas of oats would be a big advantage to the district, as apart from helping to replenish reserves of fodder it would greatly help to overcome diseases.

In the Patchewollock competition first place was gained by Mr. C. Loxton, who exhibited a very nice crop of Free Gallipoli and Yandilla King. Nice crops were also shown by Messrs. Stacey, Lyons, and Brydson.

In the Royal Competition, zone 5, the pride of place goes to Mr. E. McLean, of Baring. This crop of Free Gallipoli, Sepoy, and Currawa was indeed a credit to the grower. It was sown at the end of May

and early June with 60 lb. of seed and 90 lb. of super. It was very clean and had been well drilled. Considering that this land was taken up only a few years since, the crop reflects great credit on Mr. McLean.

In the Patchewollock fallow competition first place goes to Mr. R. G. Hynam, who exhibited a very good fallow. It was ploughed at the end of June and scarified in August. It was very well charged with moisture. Mr. L. Stacey also scored well for moisture. Apart from these two fallows, there was very little moisture to be found.

Considering the season passed through, the crops and fallow are a credit to the competitors. With the return of good seasons these districts will produce wonderful crops.

Details of the awards are as follow:—

Dennys, Lascelles Cup Competition.

FALLOW 1928, AND CROPS 1929.

Conducted by the Patchewollock Branch of the Better Farming Association.

Competitor.	Yield.	Type.	Absence of—		Even-ness.	Total Crop, 1929.	Total Fallow, 1928.	Grand Total.
			Weeds.	Disease.				
Possible Points	35	20	15	15	15	100	100	200
C. Loxton	24	17	13	9	13	76	87	163
A. J. Brydson	17	17	13	12	10	69	88	157
L. L. Stacey	19	17	13	11	13	73	83	156
A. Jackson	15	17	12	12	10	66	89	155
J. W. Lyons	20	16	12	12	11	71	83	154
W. G. Hynam	16	17	12	10	10	65	85	150
R. Thompson	17	16	13	8	10	64	79	143
H. C. Peters	12	10	11	10	8	51	91	142
W. Scholz	12	15	11	8	8	54	86	140

Royal Agricultural Society's Trophy.

100 ACRES FALLOW 1928, AND CROP 1929—ZONE 5, PATCHEWOLLOCK AND BARING.

Competitor.	Yield.	Type.	Absence of—		Even-ness.	Total Crop, 1929.	Total Fallow, 1928.	Grand Total.
			Weeds.	Disease.				
Possible Points	35	20	15	15	15	100	100	200
E. McLean	28	18	14	13	14	87	88	175
C. Loxton	33	17	13	9	12	74	87	161
L. Stacey	19	17	13	11	12	72	83	155
M. U. Walsh	15	16	12	11	11	65	89	154
A. J. Brydson	15	17	13	12	10	67	86	153
A. Jackson	14	17	12	12	10	65	87	152
J. W. Lyons	19	16	12	12	10	69	82	151
W. G. Hynam	16	17	12	10	10	65	85	150
R. Thompson	17	16	13	9	10	65	79	144
C. Bulland	17	16	12	10	10	65	77	142
H. Peters	11	10	11	10	8	50	91	141
L. G. Stewart	14	17	10	10	8	59	81	149
C. Maginness	10	11	9	10	8	48	76	124

Dennys, Lascelles Cup.

75 ACRES FALLOW 1929, AND CROP ON SAME FALLOW 1930.

Competitor.	Mulch.	Moisture.	Absence of Weeds.	Cultivation.	Total.
Possible Points	25	25	25	25	100
R. G. Hynam	21	21	24	21	87
W. Scholz	20	16	23	18	77
L. L. Stacey	20	21	19	16	76
G. Bugge	17	15	23	16	71
J. W. Lyons, No. 1	17	15	23	16	71
J. W. Lyons, No. 2	16	15	23	16	70
H. C. Peters	16	15	24	15	70
A. Jackson	16	16	23	15	70
A. J. Brydson	16	17	19	15	67
W. G. Hynam	16	17	19	15	67
D. Maloney	15	15	21	15	66
J. W. Lyons, No. 3	15	15	20	15	65
J. W. Lyons, No. 4	15	15	20	15	65

THE PROGRESS OF HERD-TESTING.

By Mr. W. J. Yuill, Senior Dairy Supervisor.

Under various names, the organized weighing, testing, and recording of individual cow's milk is carried on in nearly every dairying country of note. The Danes speak of "Control Societies," England and Scotland of "Recording Societies," the Americans of "Dairy Cattle Improvement Societies," while "Herd Testing" and "Herd Recording Societies" are terms in common use in other places. Whatever the name may be, the basis of the work is the same, viz., to determine the producing ability of each of the herd cows. In some of the old world countries, recording of the milk yield has been practised for upwards of 100 years, while for a very long period the churn test was in use to establish the butter-producing ability of individual cows.

Originally in older countries herd testing work was used extensively to determine the digesting ability—or in other words—the dairy aptitude of the milking cows. As the cows were stabled for several months in the year, an account could be kept of the food required by each cow; herd testing made it possible to ascertain each cow's return, and thus each individual's profit could easily be reckoned. It was soon noticed that even under similar conditions a very great variation in milk producing ability might exist between the individual members of any herd. In some herds the cost of producing a pound of butter-fat was found to vary from 6d. to 50d. a lb.

Any commercial enterprise whatever requires some form of book-keeping, and in view of the great disparity in the earning ability of the herd units, bookkeeping in dairy farming is essential. Herd testing and recording is the most practical form of bookkeeping that can be applied to dairy farm work, because it enables the farmer to individualize his herd, and definitely know each cow's producing ability. Where the cost of feed and labour is carefully kept, it is possible to ascertain the production cost for each cow. It is long

since it was first discovered that there was a great difference in the butter return. This was found to be due to the difference in the "test" or percentage of butter-fat in the milk.

Because it was necessary to set the milk separately, and skim and churn the cream from 24 hours' milk in order to ascertain the amount of butter produced by a cow in one day, the churn test did not become popular. Even Fjord's apparatus for determining the amount of cream in milk required 45 minutes to complete the test. This system was introduced in 1878. In 1890 the Gerber and Babcock tests were introduced. In both systems the basis of comparison is butter-fat, not milk, cream, or butter, as had been the case formerly. Gerber and Babcock have made it possible to do in less than fifteen minutes what originally required 24 hours.

The new method was soon found to be particularly suitable to dairy herd test work, and in April, 1895 thirteen Danish dairy farmers from near Vegen formed themselves into a co-operative group and organized the first "Control Society." The number of cows tested was 300. There are now nearly 1,200 "control societies" in Denmark testing approximately 500,000 cows. Germany leads the world in the number of associations and cows under test. In the 2,243 German associations the number of dairy cows being tested is greater than the total number of cows in the State of Victoria. Sweden has over 600 societies, as also has Finland. Holland has 580, while in the United States of America there are 1,000 units at work. Probably no country is making greater progress in this respect than is New Zealand. A recent report shows that they have now 260,000 cows under test, or about 19 per cent. of the entire dairy cow population of the Dominion.

Early History of Herd Testing in Victoria.

The first effort to organize a herd testing association in this State was made in 1913 by the management of the Bloomfield Butter and Cheese Company. The attempt, however, proved fruitless.

In July, 1914, Mr. J. Byrne, of New Zealand, visited Colac, and succeeded in organizing an association similar to that known as the "Farmers Union Herd Testing System." Unfortunately this system did not prove to be popular, and gradually ceased to function.

Efforts were also made to organize similar associations at Ballendella, Leongatha, Foster, Sale, and Hill End. In each instance the attempt was a failure. It is interesting to note the extensive swing over in New Zealand from this system to the group system, which is the form of herd testing so widely organized throughout Victoria.

The Group System.

In the "Farmers' Test," the whole of the work except the testing and recording is done by the farmer. In the group system a testing officer carries out all the work from the weighing of the milk to the preparation of the annual report of the herd.

It was not until 1921 that organized herd testing gained a permanent foothold in this State. Activities at Yinnar and Tarwin Lower resulted in associations being organized. At both places testing began in the early spring. During the following year new associations were formed at Mirboo, Stony Creek, Toora, and Welshpool, and in the following year at Boolarra, Narracan, and Yarram.

Evidence of the usefulness and suitability of the group system of herd testing may be gauged from the fact that the first eight associations tested 5,600 cows in 200 herds. These same associations are now testing 14,000 cows in 456 herds, and nineteen testers are employed.

In the province of Gippsland there are 56 units operating. Approximately 25 per cent. of the total dairy cows are now under test. Maffra with six units is the largest association in the State; Tongala has four; Yinnar, Narracan, Stony Creek, Leongatha, Jindivick-Neerim, Traralgon, Warrnambool, and Nalangil each has three units, while in 24 other associations a second unit has been formed. There are now 130 units operating, testing in round numbers 90,000 cows on 3,000 dairy farms.

A Controlling Body.

For the first four years the whole of the herd testing operations were in South Gippsland. In July, 1922, a conference was held at Stony Creek to consider the best means of standardizing the new movement. At the conference a central body was formed of two delegates from each association. This body was known as the "Gippsland United Herd Testing Association." Mr. Fred McIvor, of Tarwin Lower, was the first president.

The work was greatly stimulated by the granting of a subsidy by the State Government, and following the tours of the Better Farming Train in 1924 and 1925 a number of new associations were organized.

As the work had by this time extended beyond Gippsland, a conference of delegates from all associations was held at the Show Grounds at the time of the Royal Show in September, 1925, and from this very enthusiastic and representative meeting came the unanimous desire for the State-wide organization. From that date the movement has been known as the "Victorian United Cow Testing Association."

It is a legally constituted body having definite representation from definitely prescribed areas. These areas are "Main Gippsland," "South Gippsland," "North-East," "Western," "The Goulburn Valley," and "Northern Irrigation" areas. The council (or governing body) is thoroughly representative of the whole State. Each association unit may send one delegate to the annual conference when each area elects its own representation on the central council. The council meets in Melbourne quarterly to deal with matters appertaining to the welfare and development of the whole herd testing movement.

Development Work.

During the comparatively short history of organized herd testing much work of a sound nature has been accomplished by the central council. Questions which received its early consideration were—the disposal of the "cull" cow, the elimination of the nondescript bull, the segregation of the best grade heifer calves, and the introduction of a field day for testing dairymen.

In quite a different sphere the council has been able to serve the members of the various units, for by contracting for herd testing equipment substantial reductions in prices have been gained.

The Cull Cow.

This question has received very much consideration from many sources. If practicable, cull cows should be speyed and fattened. In this way some thousands of inefficient cows have been disposed of during the past few years.

Some authorities would prefer that the low producing cows should be branded with a distinctive mark; others would place the brand on the high producers.

By a branding system which has been praised by interstate dairy experts, every herd-tested cow now carries an individualizing brand, this brand is also shown on the yearly record card. Therefore, it is now possible to trace any cow to her owner and her association. It also makes it possible to value each cow, according to her production, after allowing for any factors which may have operated during the lactation.

From its inception the central council has championed the cause of the "better herd sire." In the calf-marking scheme which has been introduced this year only the progeny of "production bred" pure bulls will be recognized. It is not sufficient that the bull shall be pure bred—the production of his dam must have reached the age standard required in the standard test.

V.U.C.T.U. Calf-marking Scheme.

The calf-marking scheme mentioned has for its object the concentration on the female progeny of the best grade cows. These calves will be registered on the production of their dams, providing the sire is pure bred. In the instance of both the grade dam and the dam of the pure-bred sire, production records are demanded. Eligible calves will be tattooed in one ear within 30 days of birth, the tattoo in the ear will correspond with the fire brand on its dam. In this way there will be a definite connexion between a good cow and her daughters for all time. The letter "H" in a diamond will be tattooed in the other ear. This is the registered mark of the scheme. The age of the calf will also be shown by a letter of the alphabet.

It is safe to forecast that the calf-marking scheme will develop a keener interest in "production bred" stock. Dairy men generally are building up their herds in this manner. The leading grade herds have been bred from selected stock. It is hoped that the scheme will have the effect of concentrating on the best calves, so that when surplus calves are available for public sale there will be a guarantee of production on the dam's side, and of pure breeding and production on that of the sire.

Herd Testing Field Day.

The council has shown enterprise in the arranging of a special train tour to leading dairying centres. Through this medium herd-testing dairymen from various parts of the State may meet and discuss dairy farming problems. Incidentally while spending a day with leading dairy farmers an opportunity is afforded to see other parts of the State. It may be confidently expected, that by inspecting successfully managed commercial dairy farms and observing the breeding and feeding systems, a spirit of emulation is bound to develop.

Dairy farmers are notoriously parochial in their thoughts and work. For one reason the nature of their work prevents them from travelling very much, yet "I have heard" is now giving place to "I have seen." Field days give an opportunity for noting pasture management, the variety of seed and the amount of fertilizer used, and to see the different forms of conserving fodder, both as ensilage and hay, also the lay-out, &c., &c., of sheds and yards.

Some Wonderful Results.

In the first annual report of the herd test work the highest herd average was 257 lb. butter-fat, and the highest association average was 196 lb. per cow. During last year twenty associations surpassed the level of the test herd of only eight years ago. Nearly 650 herds have averaged over 250 lb. butter-fat; of these 181 have given over 300 lb., 46 have exceeded the 350 lb. average, while 9 have passed the coveted 400 lb. mark. The highest herd average was 463 lb. per cow. More than 120 individual cows have yielded over 500 lb. butter-fat; 12 of them gave over 600 lb.; one gave over 700 lb., and the top cow of the year yielded 829 lb.

Nine years ago the scrub bull was common in every district, to-day 60 per cent. of the herd testing dairymen own a pure bull, and between 30 and 40 per cent. of the herd cows under four years of age.

In New Zealand remarkable results have been obtained from "feeding, breeding, and weeding." Victoria, however, does not suffer by comparison even though our testing period is 30 days shorter, being nine months compared with ten months.

Cream returns of £20 a cow were considered exceptional a few years ago, and are rare still in many districts. But from £22 to £25 per cow is a common enough return now; while £30, and as high as £34 10s., has been obtained for cream alone.

Though much has been done there is still much to do. Greater concentration on breeding for higher efficiency in our cows, and more knowledge of their feeding requirements are the stepping stones to better dairy returns. Our best herds are equal to the best anywhere, but the average return can be greatly improved.

(To be continued.)

AN IMPROVED MILKING STOOL.

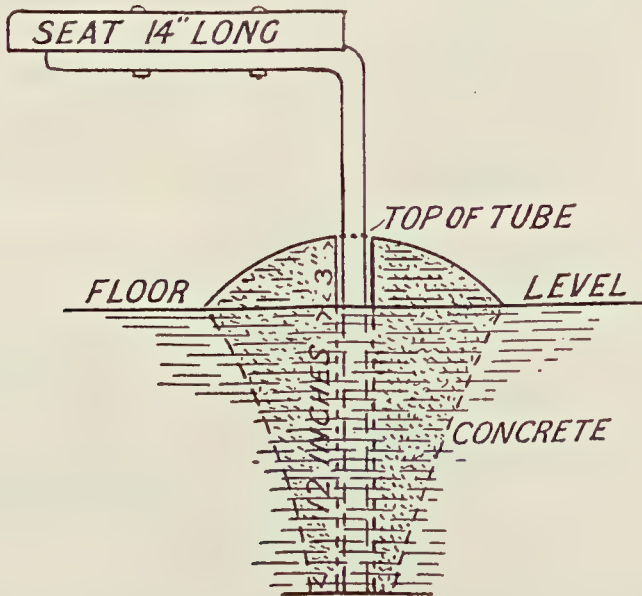
By J. Matthews, Dairy Supervisor.

In these days, when the competition for butter markets is becoming ever keener, it is highly essential that full advantage should be taken by dairy farmers of any and every contrivance which makes for improved hygiene, and consequently a better quality of produce.

How often one sees old, dented kerosene tins being used as milking stools! The indentations on the sides and bottoms caked up with cow manure, and with stale milk from the hands of the milkers over a long period of use. The same might be said of the leg-ropes used. As the leg-rope and the milking stool are usually the last things handled by the milker prior to milking, it becomes highly imperative that both should be kept in a clean condition.

It is utterly impossible for butter of the first quality to be produced from milk drawn by contaminated hands. The contamination caused by using improper stools can be avoided, to a large extent, by the use of the stool described below. Where milking machines are employed, and the double bail exists, this stool has a great and distinct advantage over the type ordinarily used.

The stool is made as follows:—Take a piece of iron pipe, 15 inches long and $1\frac{1}{4}$ inches in diameter. Sink 12 inches of this pipe in concrete at a point most convenient for milking—generally about 24 inches from the milking side of the cow. There is then 3 inches of pipe projecting above the shed floor. To prevent any injury to cows slipping and falling on this projecting pipe, place around the neck a ring or shoulder of concrete, which should be gradually bevelled off after the style of the roof of an under-ground tank. The object of having the



tube projecting 3 inches above the shed floor is to prevent the cow manure, slush, &c., getting into this pipe at cleaning times, and creating a foul spot which it is so necessary to guard against where milk is being handled. Then take a piece of solid iron bar, 1 inch in diameter and 20 inches long; flatten one end for 9 inches, and make in it two holes 6 inches apart to hold a couple of bolts to secure the seat. The seat may be made of 9 inch x 1 inch wood. It should be about 14 inches long, and may be covered with plain galvanized sheeting or plain iron plate half an inch thick. The iron bar should be bent at right angles in the middle, and if the round end be put into the pipe embedded in the concrete it will give a seat which works after the style of a swivel.

One of the reasons why the use of such a stool is advocated is because it cannot be carried from bail to bail, as is the case with kerosene tins, boxes, &c., and therefore the milker's hands need never come in contact with it.

ORCHARD AND GARDEN NOTES.

The Orchard.

YOUNG TREES.

Young trees of the Citrus family should now be making a good, thrifty growth. The foliage should be glossy, and its general appearance a bright green and healthy one. Occasional light waterings, as well as mulching of grass, or of well-rotted manure, will be helpful to the trees.

Young deciduous fruit trees will also benefit by having a grass or manure mulch; and, if it has not previously been attended to, unnecessary growths in the centre of the tree and on the main leaders should be removed.

FUMIGATION.

Evergreen trees, including those of the citrus family, that are infested with scale, should now be sprayed or fumigated to rid the trees of this pest. For spraying, a weak red oil emulsion, lime and sulphur spray, or resin wash will be found useful. The most successful method, however, of dealing with the scale pest is by fumigation. The trees should be closely enveloped in an airtight sheet or tent, and hydrocyanic gas generated inside. The chemicals for generating the gas, as well as the fumes of the gas itself, are excessively dangerous, and great care is necessary in their manipulation. The operator must take care that not the slightest portion of the fumes is breathed. Fumigation should be carried out at night-time or on a cloudy day, if the foliage of the trees be thoroughly dry.

Fumigation of citrus groves is now being carried out by Departmental officers under the management of the Citriculturist.

The Vegetable Garden.

Celery crops will now be a prominent feature in the vegetable section. The seed may be sown from January to March, and succession plantings should be carried out occasionally during those months. The growth of celery should be quick; a fair supply of water and a good rich, loose soil are helpful to its growth.

Ample water will now be required in the vegetable garden. The surface should be kept well hoed, and mulchings of manure given wherever possible.

Cabbage, carrot, turnip, radish, lettuce, peas, cauliflower, &c., seeds may now all be sown, and young plants from any seed beds planted out.

The Flower Garden.

Constant watering and hoeing will now be required for successful gardening. Cannas will require manuring; the old flowering stem should be removed to make way for the new growths. Dahlias and chrysanthemums will need a great deal of attention, staking the growths as they develop, disbudding, thinning out weak shoots, and removing unnecessary growths. The dahlias should receive a good soaking of

water during the hot weather, and liquid manure or quick acting fertilizers given when the flower buds are developing. When chrysanthemum buds are very small, liquid manure should be applied. Roses may now be summer pruned; all weak growths should be removed, and the strong ones shortened to a fairly good bud. The plants should then receive occasional waterings with liquid manure, and be kept well supplied with water.

All flowering trees and shrubs that have finished blooming should be pruned, the flowering growths removed, and, unless the seed is required, all seed heads cut off.

Cuttings of pelargoniums, zonale and regal, may now be planted, and delphinium spikes that have finished flowering cut down to make way for new growth, the plant being watered and manured. Seeds of perennial and hardy annual plants, especially winter-flowering sweet peas, Iceland poppies, stocks, and pansies, may now be sown, and a few bulbs for early flowering planted. The beds should be well manured and deeply worked in anticipation of planting the main crop of bulbs.

REMINDERS FOR MARCH.

LIVE STOCK.

HORSES.—Feed as advised last month. Those in poor condition should be "fed up" in anticipation of winter.

Should horses not be feeding well and salivating, examine mouth for grass seeds. Horses running at grass are frequently affected by them. The seeds should be removed, and a mild mouth wash used. A very weak solution of Condy's Fluid will answer the purpose.

Grass seeds also cause blindness if not removed from the eye, and the inflammation reduced by bathing the eye with boracic solution. A teaspoonful of boracic acid to a pint of boiling water is the correct strength for the purpose. Should a scum remain over the eye inject into the eye every other day a small quantity of the following solution:—Sulphate of zinc, 4 grains; water, 1 pint.

CATTLE.—Continue to aim at the necessary succulence and balance of ration as advised for February. In the absence of green feed, good cows must be hand fed to get their due. The amount and nature should be regulated to just the economic deserts of each animal, as determined by her producing capacity. This must take into consideration the nutrient content of the feeding material. (Pamphlets on balancing the ration may be had free on application.) The concentrate should be withdrawn whenever young green crops become available that will serve the same purpose. Remember that maize alone will not suffice for this, while young millet, young Sudan grass, or young Algerian oats will largely. As advised previously, never let the yield fall even temporarily for want of feeding, so long as the return will cover the cost. See that the dry, and the young stock also, get their full needs in the way of food and water. Look to the mineral needs, and exploit the aid that bone meal, the mineral lick, and cod liver oil will give in this direction. Help the growing maize or sorghum crop (if drill-sown) by not permitting the ground surface to cake. Sow Algerian oats, 2 bushels per acre, for early grazing. Guard against dust and flies in the dairy, and take all practicable steps to keep down the temperature of the cream. Continue to regulate the use of the bull.

SHEEP.—Towards the end of March, the earliest of the northern lambs are due (late October matings), and all ewes in the northern district should be kept strong for lambing. Crutching is essential, particularly if ewes are likely to become dirty in the autumn. Wool should be cleared from

udders and well up over the tail. Young ewes of the merino or fine crosses are very apt to suffer if not crutched, and lambs may be lost in bad weather if this work is not attended to at the proper time. Clear wool from eyes also in the case of fine-wooled sheep. Handle ewes carefully when crutching if near lambing, as losses may result from rough treatment. Pure British breeds of ewes and coarse cross-breeds may be still coming into season; in such cases, rams should be left mated to make sure of a good lambing.

In almost any season foot-rot is common. Attention should be given regularly in such cases. Pare the foot (except the extreme tip of the toe) with a sharp pair of pruning shears and strong knife, and remove the diseased parts. Then apply some form of treatment; some of the patent mixtures are very good for the purpose. A mixture made as follows will be found satisfactory:—Take one quart of good Stockholm tar, and warm it until it becomes thin, and then add a cupful of powdered bluestone, and mix well (sometimes it will take quite a time to mix the tar and the bluestone thoroughly); then add two teaspoons of lysol and stir well, and then a little turpentine (just sufficient to make the mixture as thin as paint). Apply with a flat brush.

Ready attention should be given to all cases of fly, ophthalmia, grass-seed, blindness, casting, pizzle trouble, &c. Write to Department for further information.

It may pay to feed oats or other concentrates to breeding ewes in low condition, in preparation for lambing. Stocks of these foods should be secured while the market is favorable for their purchase.

Reserve the best paddock near the homestead for the lambing ewes, if possible. Ample supplies of good water are still a vital necessity until the weather breaks.

PIGS.—Sows about to farrow should be provided with short bedding in well-ventilated sties. See that the pigs have shade, and water to wallow in. Pigs should be highly profitable now. Pollard should be used for very young pigs, and bran added for suckling sows, and to help to prevent constipation.

On many farms the milk supply will be diminishing, and it will be necessary to add meat meal to the grain to balance the ration. Add 10 lb. meat meal to 100 lb. of grain when no skim milk is available for the sows. Supply greenstuff where possible. See that pigs have an abundant supply of clean drinking water.

POULTRY.—Cull out the drones and get rid of surplus cockerels. Keep forward pullets well fed—eggs are rising in value. Repairs to houses should be done this month. Thoroughly cleanse all houses and pens. Spray ground and houses with a 5 per cent. solution of crude carbolic acid. The regular use of Epsom salts and sulphur once a week for the next three months, combined with strict cleanliness, will act as a safeguard against chicken pox; 1 oz. of salts and $\frac{1}{2}$ oz. of sulphur to every twenty birds should be given in the mash—salts one day, and sulphur three days after. Burn all refuse and old feathers. Provide a liberal supply of green food. For each moulting hen, add a teaspoonful of linseed to the morning mash. Drinking water should be kept in cool shady spot.

CULTIVATION.

FARM.—Work fallow where possible for autumn sowing of cereals. Sow winter fodder crops, such as rye, barley, and vetches. Prepare land for lucerne plots for autumn seeding. Make silage of maize and other crops for winter use.

ORCHARD.—Prepare new land for planting; plough deeply and subsoil; leave surface rough. Plant out strawberries after first rain. Plant crops for green manure. Continue to fight the Codlin Moth.

VEGETABLE GARDEN.—Prepare ground for winter crops. Plant out seedlings in moist soil. Sow cabbage, cauliflower, lettuce, early peas, swede turnip, beet, carrot, radish, and early onions.

FLOWER GARDEN.—Cultivate and water. Feed dahlias, chrysanthemums, and roses. Plant out shrubs, trees, and all kinds of bulbs. Sow hardy annuals. Plant geranium and pelargonium cuttings. Spray for Aphis, Red Spider, and Mildew.

VINEYARD.—Select scions, if not done last month. In cooler districts, where ripening of grapes is difficult, it may be assisted by removing basal leaves only, as soon as berries change colour. This is the month for drying currants, sultanias,

and gordos (Lexias and Clusters). Do not pick before grapes are properly ripe. For instructions for packing grapes for export, apply to Department. Shipments should be made in March and early April.

Cellars.—Vintage month. For light dry wines, pick as soon as grapes are ripe; do not wait for over-maturity, as is so often done. Pay attention to temperature control and acidity; correct latter, if deficient, with tartaric acid or late grapes. Acidimeter supplied by Department; price 10s. 6d. Sulphiting and the use of pure yeasts are strongly recommended, as they insure production of sound wine; further information supplied on application.

BEE-KEEPING.

During February bees commence to arrange their stores of honey and pollen in preparation for the coming winter, and it is therefore unwise to interfere with the combs in the brood chamber, to insert empty combs between the brood, or to change the position of the combs.

Where there is a surplus of honey in the upper story, it is best not to take the whole of it in one operation, but to take half, and when the emptied combs are filling up again take what was left. At this time of year bees will work better and keep on breeding longer with a full, or partly filled, super than with empty combs above the cluster of bees.

When there is a shortage of honey in February or March, it is best to give only enough sugar syrup to carry the bees through till April, but to give whatever amount is necessary in the shortest possible time. Feeding extending over many days will stimulate brood-rearing, and a few weeks later the bees will be short of food again, compelling further feeding.

In the case of colonies below the normal strength in the number of bees, continuous light feeding will do no harm; it will, on the contrary, be beneficial, as it increases the number of young bees, but the feeding for winter stores should be deferred till the middle of April, when but little of it will be used for brood rearing.





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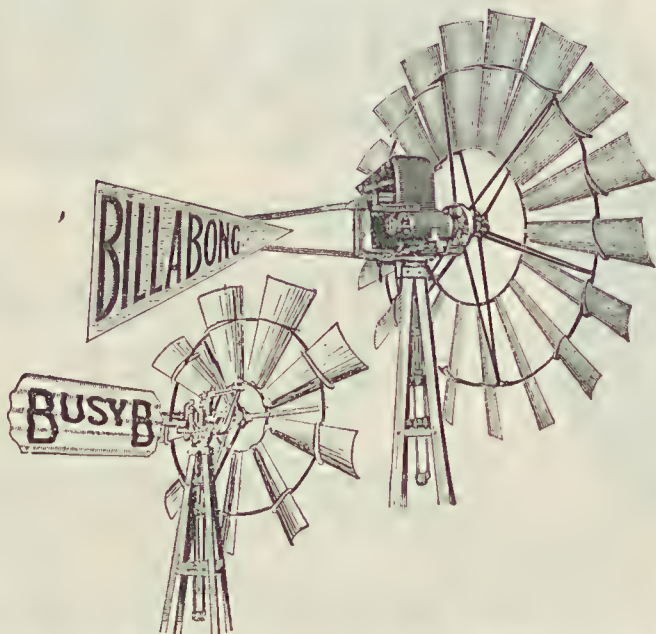
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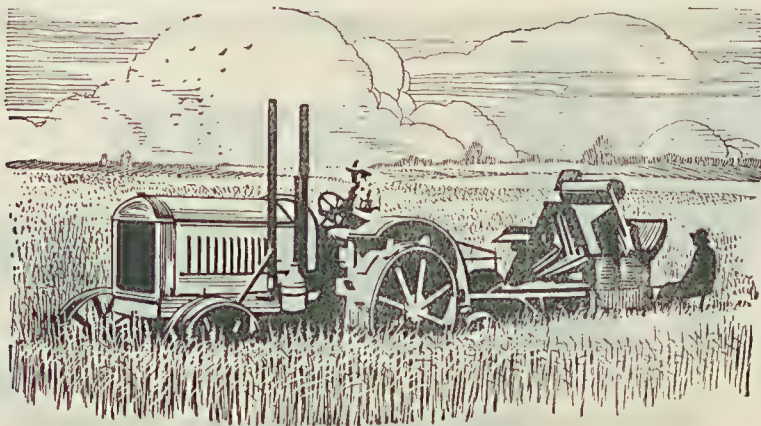
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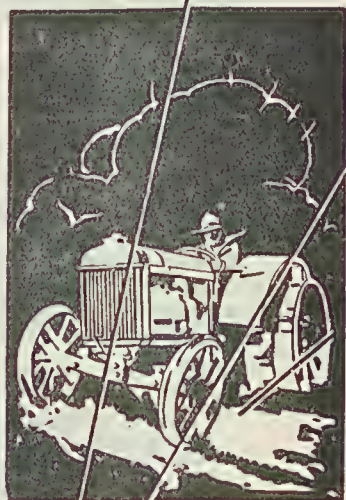
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